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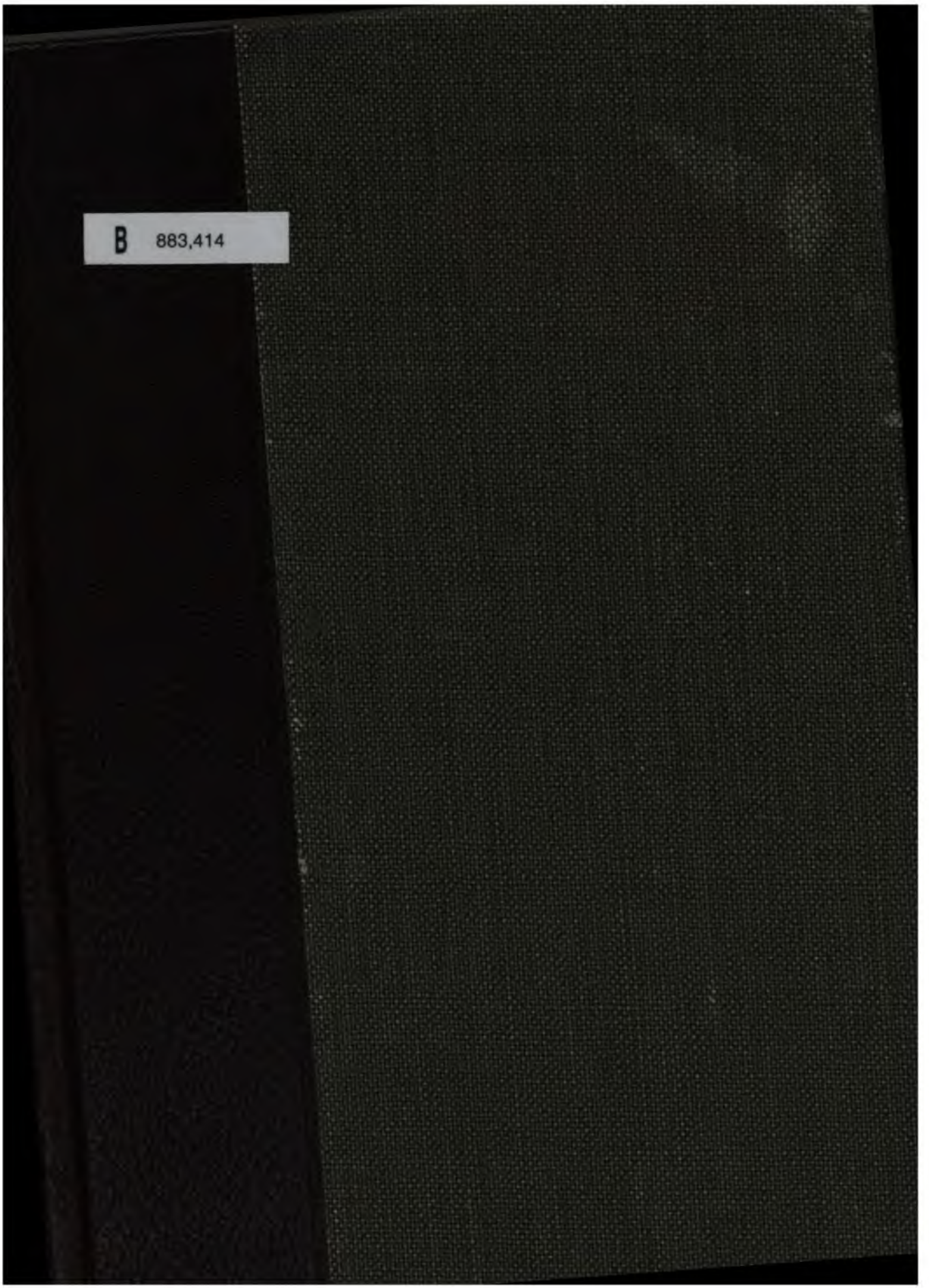
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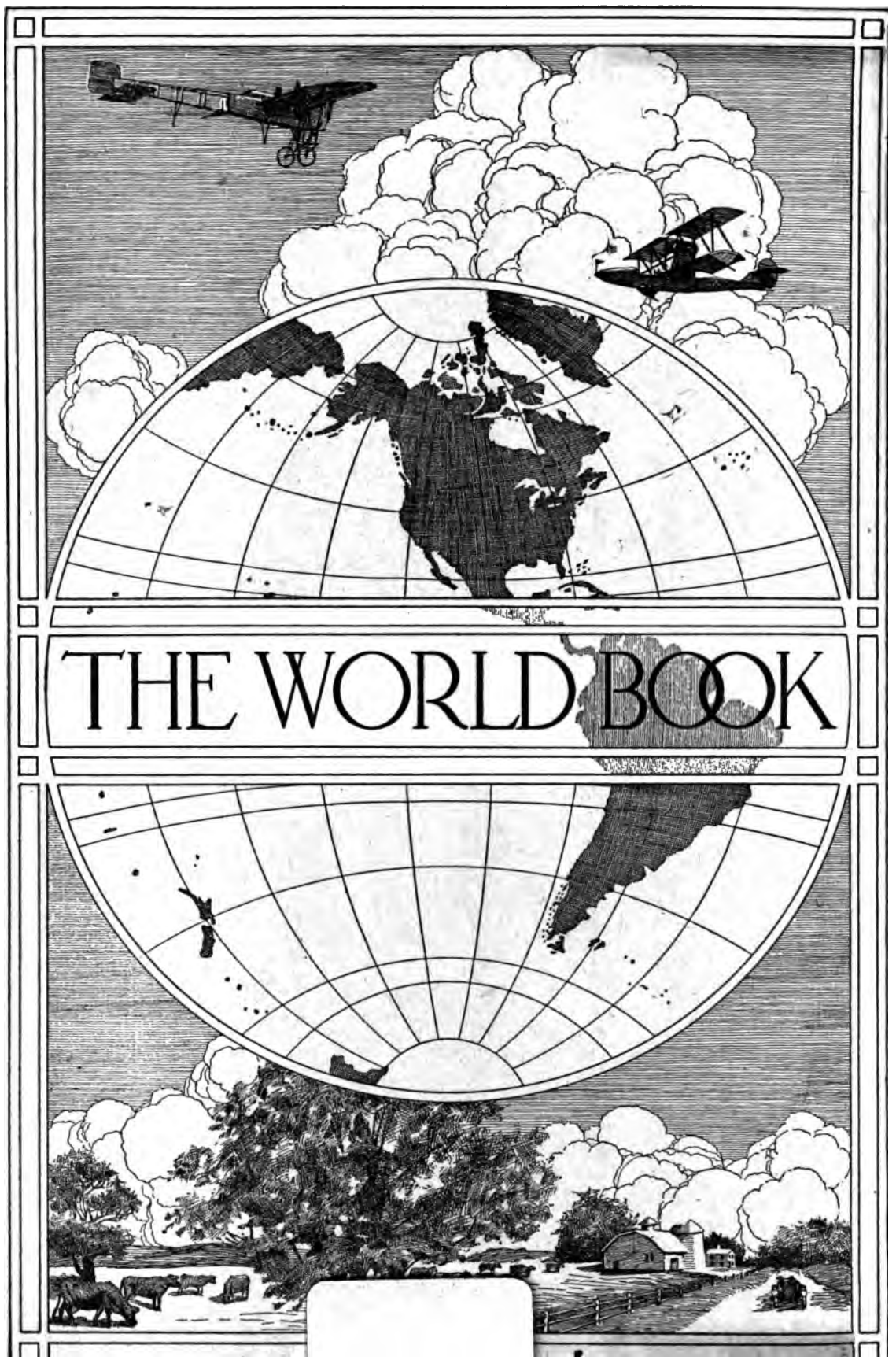
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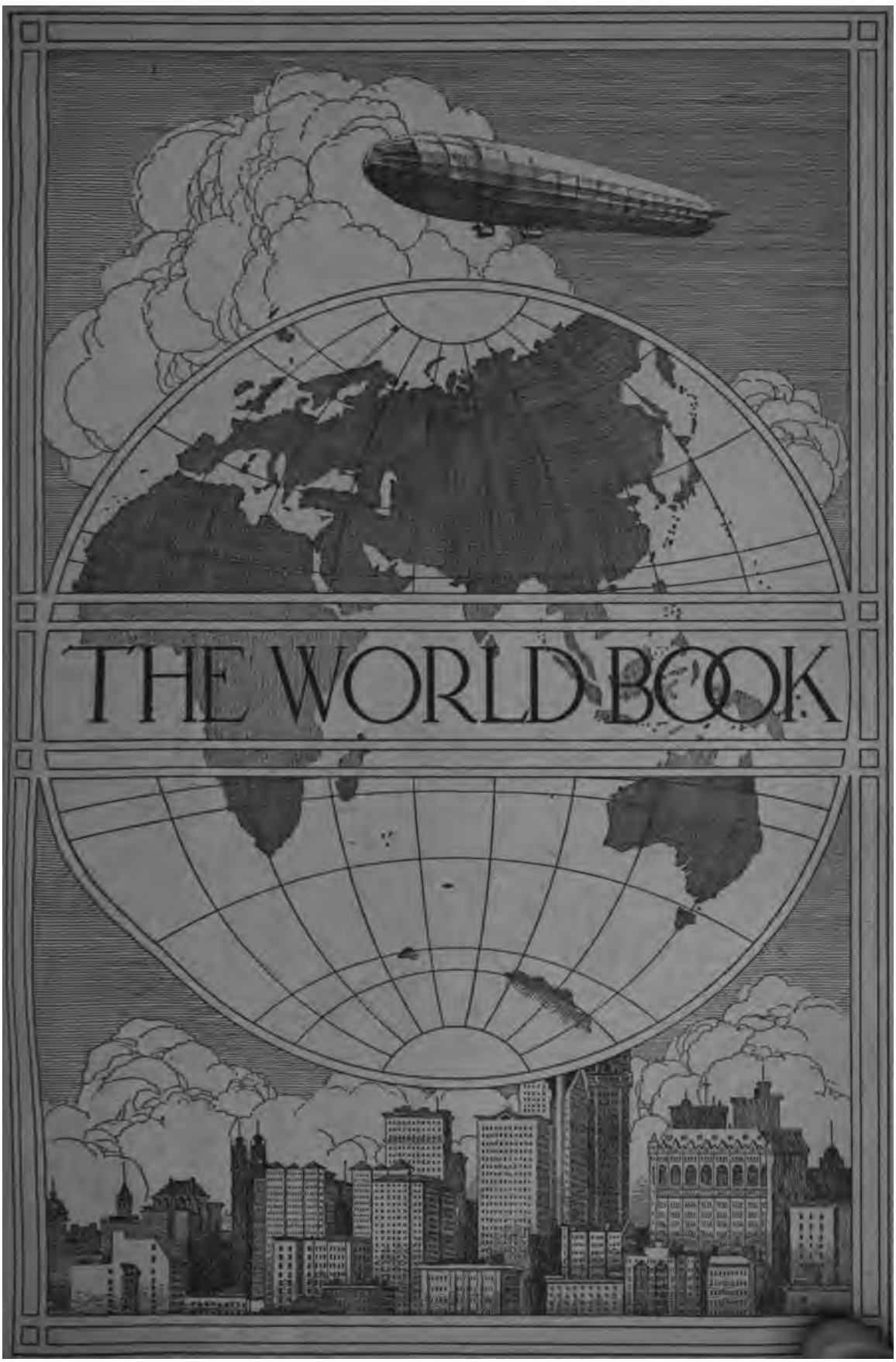
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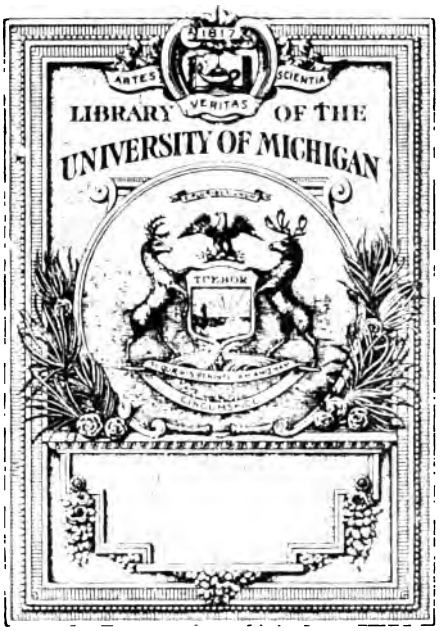

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DEPARTMENT OF EDUCATION, UNIVERSITY OF WISCONSIN
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Iron Crown of Lombardy, a name given to the crown worn by the Lombard kings and the emperors of Germany when they became kings of Lombardy. It was not precisely an iron crown, but was made of gold, with an iron band which tradition says was beaten from a nail of the Cross on which Christ was crucified. When it was made is not known, but previous to the twelfth century it was called the Golden Crown. The most notable monarchs who wore this crown were Charlemagne, Charles V and Napoleon I. It is now preserved in the Church of Saint John the Baptist at Monza, Italy.

CROWN POINT, a township in Essex County, N. Y., important for its Revolutionary War associations. It was settled by the French in 1731 and was one of the chief frontier posts during the struggle for colonial possessions. Along the natural lines of travel and communication between Canada and the colonies of England, Crown Point, a little fortress on Lake Champlain, was a strategic point, for here the lake narrows to the width of a river, and so a few small cannon could command the passage. This was called *Scalp Point* by the French, *Crown Point* by the English. At the outbreak of the Revolutionary War, while Arnold and Ethan Allen took Ticonderoga, a body of "Green Mountain Boys" under command of Seth Warner captured Crown Point, on May 11, 1775, with 200 cannon and a quantity of ammunition. A slope of the embankment with part of the ruins of the barracks is still standing.

Crown Point is 110 miles northeast of Albany and ten miles from Ticonderoga, on the west shore of Lake Champlain and on the Delaware & Hudson Railroad. Since the mining of iron ore has been abandoned, the town is dependent on its agricultural resources. Population in 1910, 2,200. A.E.R.

CRUELTY TO ANIMALS, SOCIETY FOR THE PREVENTION OF, the name for various humane organizations existing in most countries of the world, which have been influential in securing laws providing punishment for mistreatment of animals. Support is provided by popular subscription. The first society for this purpose was organized in 1824 in England. Scotland followed in 1839, and in 1866, through the influence of Mr. Henry Bergh, the first society of that kind in America was organized in New York. Other countries took up the movement and now there are similar societies in nearly every country in Europe, in Canada, Algeria, Australia, South Africa, Argentina, Brazil and Mexico. In some places laws passed through the influence of these societies regulate the treatment of wild animals in captivity as well as of domestic animals.

In nearly all countries legislation fixes a fine of from $5 to $100 or imprisonment from thirty to sixty days, or both, as a punishment for cruelty to any domestic animal. Through legislation, railways are required to unload, every twenty-four hours, for rest, feed and water, all live stock which is being shipped long distances. These societies are endeavoring to secure proper treatment of animals through education of the people rather than by force. In some cities ambulances and derricks have been provided for the removal of disabled and fallen animals. See BERGH, HENRY.

CRUIKSHANK, *krook'shangk,* GEORGE (1792-1878), an English artist born in London, famous for his caricatures. His father and elder brother were both caricaturists and at fifteen years of age he was fairly on the road to fame. He was a moralist as well as an artist, and as a total abstainer he finally consecrated his art to portraying the downward career of the drunkard. In 1837 he commenced his famous series of steel etchings illustrative of Dickens' *Oliver Twist,* which were full of pathos, humor and tragic power. For over half a century he caricatured the costumes, manners and vices of the English people.

CRUSADES, *kru saydz',* the Holy Wars of the Middle Ages, carried on from the eleventh to the thirteenth century by the Christian nations of Western Europe in the effort to wrest from its Mohammedan possessors the land where Christ had lived and died. The Crusaders took their name from the Latin word *crux,* meaning *cross,* for the Cross of Christ was their badge of warfare. No other great event of history has stirred the imagination of the world more than this long and bitter struggle for the possession of the Holy Land, and the traditions of the Crusaders are perpetuated in a collection of tales and poems of infinite variety. Sir Walter Scott's *Talisman* is one of the most celebrated stories of the Crusading period.

In the earlier pilgrimages to the first home of Christianity may be found the origin of the Crusades. From the time the Christian faith took root in Western Europe bands of pilgrims had made their way to the Holy Land to visit the sepulcher of Christ, and in the eleventh century, a period of religious revival, they

THE CRUSADES
Church of the Holy Sepulcher at Jerusalem
Peter the Hermit preaching the Crusades
The Spirit of the Crusades
At a shrine along the route
Costumes of the period
Landing of Saint Louis
BLACK SEA
MEDITERRANEAN SEA
Jerusalem
1096-99, First Crusade
1147-49, Second Crusade
1189-91, Third Crusade

ıy the thousands along the highways
ı Jerusalem. Under the tolerant rule
aracen caliphs, these pilgrims were
ated, but all this was changed when,
erusalem was captured by the Seljuk
Tartar tribe fanatical in its loyalty
th of Mohammed.

ame stories of brutal treatment and
n, of exorbitant sums charged at the
Jerusalem and of unbearable insults
hristian pilgrims. Western Europe
d to a high pitch of religious fervor
nation, and it was determined to
Holy Sepulcher from the hand of the

Besides this lofty religious ideal
e other forces arising from the spirit
e which helped the movement—love
ture, commercial ambition and the
military glory. All classes, from king
west man in the realm, had their
or joining the forces which quickly
to march. Serfs seeking relief from
ı that had become unbearable and
fleeing from justice were present in
of the Crusaders.

rst Crusade (1096-1099). The First
as inspired by the preaching of Peter
t, who on his return from a pilgrimage
ly Land aroused the multitudes every-
his vivid descriptions of the sufferings
rims. At the Council of Clermont, held
t was definitely decided to organize a
nd Pope Urban II, addressing a great
clergymen and laymen, so moved them
quence that they cried out as with one
d wills it." This became the great bat-
the soldiers during the Holy Wars.

the first Crusaders, unorganized and
fficient supplies, began the march to-
estine. Nearly all of these perished
stantinople was reached, and the few
eded in crossing the Bosporus were
es in Bithynia by the Turks. Later in
however, five well-equipped armies set
nstantinople by different routes. They
by Godfrey de Bouillon, Raymond of
Robert of Normandy (the brother of
of England), Robert of Flanders and
es.

ng Germany, Hungary and the Byzan-
re, they passed over into Asia Minor,
Nicaea in 1097, gained a hard-won
er the Turks at Dorylaeum, and in
, stormed the city of Antioch. Just a
they laid siege to Jerusalem, which
ired after a desperate struggle. God-
ouillon was chosen ruler of the Holy
ther nobles were left in control of An-
Edessa. These three cities were held
ristians for nearly fifty years, their
ing aided by the Order of Knights Tem-
Knights Hospitalers.

ond Crusade (1147-1149). The recapture of Edessa by the Mohammedans in 1144 again aroused the Christians to a holy zeal, and a second Crusade was preached by Saint Bernard of Clairvaux. Early in 1147 two great armies under the German emperor, Conrad III, and the King of France, Louis VII, started for the defense of the Cross. The expedition was a total failure, and only a remnant of the great host reached home again.

The Third Crusade (1189-1191). This was led by Frederick Barbarossa of Germany, Philip Augustus of France and Richard I (the Lion-hearted) of England, and was undertaken after the capture of Jerusalem by Saladin, in 1187. Though Barbarossa was drowned in 1190, soon after reaching Syria, his soldiers fought with the French and English at the siege of Acre, which was captured after twenty-three months. Rivalries between Richard and the French king caused the latter to withdraw a few weeks later, and Richard, sole leader of the expedition, finally concluded a truce of three years and three months with Saladin, by which pilgrims were promised the right to visit the Holy Sepulcher, unmolested, while the seacoast from Tyre to Jaffa was to remain in the possession of the Crusaders.

The Fourth Crusade, known as the "false Crusade," never reached Palestine. It was undertaken at the suggestion of Pope Innocent III, and among its leaders were Baldwin of Flanders, Boniface of Montferrat, Geoffroy of Villehardouin and Simon de Montfort. The Crusaders assembled at Venice in the autumn of 1202, but were diverted from their purpose by the Venetians, who prevailed upon them to storm the city of Zara in Dalmatia. The army spent the winter there, and in 1204 captured and sacked Constantinople. In the same year a Latin empire was established at Constantinople, with Baldwin of Flanders as its first emperor.

The Later Crusades. The first four Holy Wars are the only ones to which all authorities assign the same numbers. The name *Fifth Crusade* (1228-1229) is usually applied to that undertaken by Frederick II, the German emperor, in fulfilment of a vow. Frederick proceeded to the Holy Land and by concluding a treaty with the Mohammedans secured possession of Jerusalem. For making this truce with the infidels he was severely upbraided by Pope Gregory IX. In 1244 Jerusalem was retaken by the Mohammedans.

The *Sixth* and *Seventh Crusades,* in 1248-1254 and 1270, respectively, were headed by Louis IX of France. He led an army into Egypt, but was soon defeated and captured, and secured his release only after paying a heavy ransom. In 1270 he started on the second expedition, but died at Tunis on the way to Palestine. In this Crusade he was associated with Edward Plantagenet (later Edward I of England), who landed an army at Acre in 1271, but accomplished nothing. In 1272 Edward returned home, and this year is usually regarded as the end of the Crusading period.

The Children's Crusade. Of several lesser Crusades, the most remarkable is the one undertaken in 1212 by a great army of boys and girls. About 30,000 children, most of them less than twelve years of age, placed themselves under the leadership of Stephen, a French shepherd lad

who declared that God had called him to the rescue of the Holy Land. When the children reached Marseilles they expected the waters of the sea to divide and give them passage to Palestine. Bitterly disappointed, many of them made their way homeward, but several thousand were lured on board seven ships by merchants who promised to take them to Palestine free of charge. Two of the vessels were wrecked off the coast of Sardinia, and the others carried the children to Alexandria, where they were sold into slavery.

About the same time another crusading band, consisting of 20,000 children, started southward from Germany, under the leadership of a boy named Nicholas. Thousands died of hunger and exposure on the way, and the remainder got no farther than Geneva. Few of these ever reached home again.

Results of the Crusades. Though the Crusaders failed to realize their great ideal, the Holy Wars profoundly influenced European history. By their warfare against the Turks the Crusaders delayed the fall of Constantinople three centuries, giving the young Christian civilization of the West an opportunity to conserve its strength before Mohammedanism again gained a foothold in Europe. By promoting commercial intercourse between the West and the East the Crusades added much to the wealth and prosperity of Europe, and were an important factor in the development of the great Italian seaports.

The Holy Wars helped to destroy feudalism, for large numbers of the nobles perished in the Crusades or lost their fortunes and their estates, and the power of the kings and common people was correspondingly increased. Europe also developed intellectually by these centuries of contact with the more advanced culture of the East. Finally, the Crusades awakened the spirit of exploration and discovery, and therefore played an important part in the epoch-making voyages of the fifteenth and sixteenth centuries. B.M.W.

Consult *Chronicles of the Crusades,* in "Everyman's Library"; Archer and Kingsford's *The Crusades.*

Related Subjects. The following articles in these volumes will give added light on the Crusades and on the period in which they occurred:

Bernard, Saint	Louis, subhead
Edward, subhead	*Louis IX*
Edward I	Peter the Hermit
Feudal System	Richard, subhead
Frederick I, Barbarossa	*Richard I*
Godfrey de Bouillon	Saladin

CRUSTACEANS, *krus ta'she anz,* members of the shellfish family named *Crustacea,* some of the larger types of which are among the favorite sea-foods of all nations, the smaller ones furnishing an important source of food to other marine animals. This family forms the most important class of joint-footed animals, the Arthropoda (which see). The familiar crawfish, crab and lobster are three of the best known of the 10,000 present species of crustaceans, most of which are sea animals, although a few are found in fresh waters and on land.

Although the structure and also the habits of crustaceans vary, all have a hard body coating; in some this is almost bonelike, while in others it is merely tough and leathery. The body consists of a number of segments, either free or joined together. All appendages, such as legs, feet, feelers (antennae) and jaws are arranged in pairs and are jointed. There are two or more compound or single eyes, usually stalked. The animals are reproduced by means of eggs which are generally hatched in water, although some species, like lobsters, carry eggs and young on the under side of the abdomen. As the animals grow, their skins become tight and a painful process of casting off skin and shell and growing new coverings must be passed through. Crustaceans possess great powers of reproduction of lost parts, such as feet, claws and feelers. Most of these animals eat decaying animal matter and so are useful in ridding waters and beaches of carrion.

Related Subjects. A more detailed knowledge of the structure and importance of the crustaceans may be gained from a study of the following articles:

Barnacle	Horseshoe Crab
Crab	Land Crab
Crawfish	Lobster
Fiddler Crab	Shrimp
Hermit Crab	

CRYPT, *kript,* a word derived from the Greek *kryptein,* meaning *to hide,* and now applied to a vault under an old church or cathedral in which the bodies of saints and martyrs were placed. The crypt was usually the nucleus of the church which was to be erected over it, elevating the altar of the saint to whom the edifice was dedicated. In early ages the crypt also contained altars for the worship of saints and martyrs whose bones were supposed to be deposited there. One of the most famous and beautiful of existing crypts is found beneath Glasgow Cathedral, made famous by Sir Walter Scott in his novel *Rob Roy.* Saint Peter's, Rome, and the cathedrals of Canterbury and Gloucester also contain crypts of great historical interest and architectural beauty.

CRYPTOGAMS, *krip'toh gamz,* or **FLOWERLESS PLANTS,** is a term which includes all plants which do not bear seeds. The name is derived from Greek words meaning *hidden marriage,* or "reproduction that is difficult to see." Among the cryptogams are the ferns, the mosses and the algae and fungi. The name is really applied in error, due to the fact that it was at one time believed that stamens and pistils were the only sex organs and so the reproduction of flowerless plants seemed obscure. The sex reproduction of cryptogams by spores is really more clear than that of *phanerogams* by seed. See BOTANY; PHANEROGAMS; SPORE.

CRYSTALLINE, *kris'tal in,* **ROCKS.** Granite and marble, especially when polished, show that they contain a great number of crystals cemented together. Rocks having this structure are called *crystalline rocks.* Some varieties of quartz, limestone and hornblende are masses of crystals and make very beautiful cabinet specimens. Most crystalline rocks once existed in a molten state and crystallized as they cooled. See IGNEOUS ROCKS.

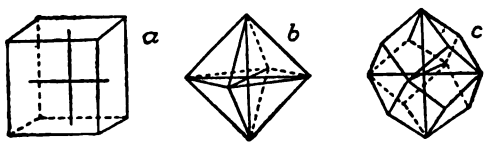


FIG. 1

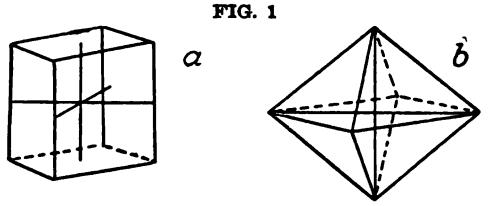


FIG. 3

CRYSTALLIZATION, *kris tal i za'shun.* Let us make some rock candy. We will dissolve granulated sugar in hot water until we have a syrup. We will then stretch one or more strings across the vessel in the syrup and set it away to cool. In a few hours clusters of crystals will be formed about the strings, and these crystals make our rock candy. Let us examine them. How many sides have they? Are all the sides the same size? Do all the crystals have the same number of sides? Get some rock salt and compare it with the crystals of sugar. How do they differ? Dissolve as much alum as you can in hot water. Stretch strings [illegible]ugh the solution and let it cool. How [illegible] crystals of alum differ from those of [illegible]r and the salt?

By these experiments and the examination of the substances with a magnifying glass, we learn that many solid substances are formed by masses of crystals crowded together. This method of formation is called crystallization.

Systems of Crystals. Notwithstanding the large number of crystals, they are all systematically arranged and are classified under six systems, all of which are based upon the cube and its modifications. To illustrate, the cube has six sides or faces. If we cut four of its edges we have increased the number of faces to ten; if we cut all the edges we increase the number to eighteen. Now if we cut the corners we have a solid with twenty-four surfaces. The systems of classification are as follows:

The Regular Cubic System. The perfect crystals of this system are cubes. Common salt, iron pyrite, galena, lead ore, silver, copper and gold are all illustrations of this system (Fig. 1). By cutting the cube as shown in *b* a double pyramid with equal faces is formed. By cutting the edges as shown in *c* we have a crystal with twelve equal sides. Alum and the garnet are good illustrations.

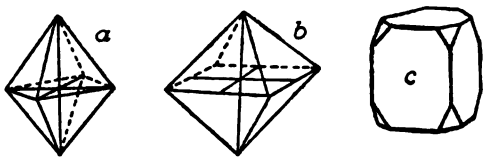


FIG. 2

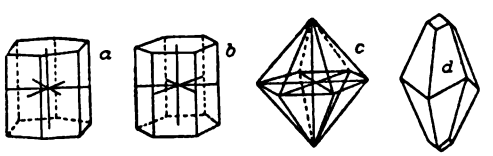


FIG. 4

FIG. 5

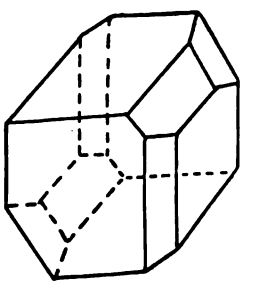


FIG. 6

The Square Prismatic System. The rectangular prism forms the basis of this system (Fig. 2). This gives the prism and the

pyramid in various combinations illustrated in *a*, *b* and *c*. There are no common substances illustrating this system.

The Right Prismatic System. The basis of this system is a prism whose bases are oblongs (Fig. 3). By cutting the faces we have the double pyramid with unequal faces, *b*. The topaz and sulphur crystallize in this system.

The Six-Sided Prismatic System. This is generally known as the *hexagonal* system. Its foundation is a six-sided prism, *a* (Fig. 4). The modifications are illustrated by *b*, *c* and *d*. Quartz, ice, snowflakes and calcite crystallize in this system.

The Oblique Prismatic System. The foundation of this system is an oblique prism (Fig. 5). Sal soda, borax, gypsum and copperas crystallize in this system.

The Double-Oblique Prismatic System. This system differs from No. 5 in having all the faces of the crystals oblique to each other (Fig. 6). The crystals are complex. Blue vitriol and some forms of tartaric acid are good illustrations. W.F.R.

CUBA, an island republic, poetically called the PEARL OF THE ANTILLES because of its beauty and natural wealth, lies at the entrance to the Gulf of Mexico, dividing the opening into two channels. It is ninety miles south of Key West, Fla., and about 130 miles east and north of Yucatan. About fifty miles to the east is the island of Haiti. Havana, the chief port and an important city, is 1,197 miles from New York and 597 miles from New Orleans.

The name, a relic of the original inhabitants, now extinct, is pronounced *Kooba* by the islanders, and this is not unlikely to become the general pronunciation in North America with the increasing intimacy of international relations, since it is a point on which some local sensitiveness has been shown.

Cuba was one of the earliest American possessions of Spain, and was one of the two last to slip away from Spanish rule. For ages it has been a favorite winter resort for people of northern lands, and its history has been at times so closely connected with that of the United States as to render it especially interesting to Americans. Since 1900 it has been an independent republic, with some concessions of guardianship to the United States. Including numerous small islands, or *keys*, at the north and south, and the Isle of Pines at the south, all of which are a part of Cuban territory, the area of Cuba is about 44,164 square miles. It is therefore almost as large as Pennsylvania, or New Brunswick and Nova Scotia combined.

The People. The population of Cuba in 1916 was approximately 2,500,000, of whom about 1,795,300 are whites. The remainder are chiefly negroes and negro mixtures, but there are 12,000 Chinese. The prevailing religion is the Roman Catholic. The white families have nearly all been settled for generations on the island, and were long restless under the Spanish rule, for the reason that they were treated merely as provincials or dependents and excluded from participation in the executive responsibilities and honors of the insular government; the latter were monopolized by officials from the mother country. The term *pobre Cubano* (poor Cuban), applied to them in Spain, wounded their sensibilities.

There was much of class distinction in Cuba under the rule of Spain. The wealthy were educated and refined, but no adequate provision was made for the education of the poor. The census of 1899 showed that sixty-four per cent, or nearly two-thirds, of the people were unable to read or write. The Church fostered education and charities, but the government was neglectful of both.

It will be seen that the people of Cuba, of whatever class, have been, until recently, depressed and dissatisfied with conditions, although possessing a land of beauty, fertility and promise and enjoying the very valuable cultural inheritance from Spain; and that the

provincial character ascribed to white Cubans was artificial rather than real. The Spanish language is everywhere spoken, and the elegance of Spanish social forms is in evidence.

Education. During Spanish rule in Cuba education was largely controlled by the Church, but provisions made therefor were insufficient.

A RURAL HOME

Such houses are occupied by fairly prosperous people.

While Americans were occupying the island (1898-1902) the school system was reorganized, and by 1907 census returns showed that sixty-nine per cent of the people could read. Primary education is free and compulsory. In 1914 over 277,000 pupils were enrolled in nearly 2,400 public schools, but the average attendance was but a little over half that number. There is a university at Havana, attended by over 1,200 pupils, and the liberal arts and sciences, medicine, pharmacy and law are taught.

Commerce and Principal Cities. The most important cities of Cuba are seaports. Havana, the capital, on the northwest coast, is the chief port and the tobacco center of the republic. Ships from all parts of the world enter its harbor. It has few wharves, but this condition is of financial advantage to those who make a business of removing cargoes. Ships anchor off shore and cargoes are removed by lighters. It has been estimated that it costs as much to bring a ton of freight to shore at Havana as to ship it all the way from Liverpool.

Connected with Havana by rail are Santiago de Cuba, the mineral and sugar port at the southeast; Matanzas, a northwestern port, the most noted sugar center of Cuba; Cienfuegos, on the south-central coast, another important sugar center; and Camagüey, the largest city in the interior. Each of these five cities is more fully described elsewhere in these volumes.

Since Cuba's independence in 1898 its commerce has turned largely to the United States. In recent years over eighty-nine per cent of its export trade has been with the United States and its possessions, nine per cent with the United Kingdom, about two per cent with Germany and less than one per cent with Spain, the nation which at one time had a monopoly on Cuba's commerce. Americans, to succeed in business in Cuba, should speak the Spanish language and study to accommodate themselves to the easy-going Cuban temperament.

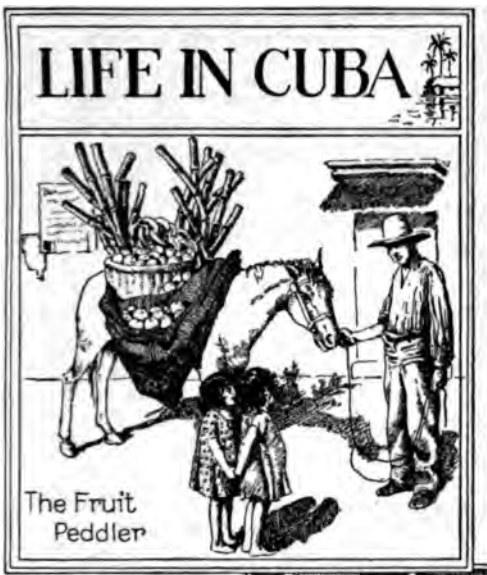
Sugar forms over seventy-five per cent of the exports, and tobacco twenty per cent. The principal imports are cotton goods and machinery. Yearly exports of Cuba have been valued at about $165,000,000 and imports at almost $125,000,000. Although Cuba has its own system of coinage, United States money is legal tender throughout the island.

Transportation. The Cuban government is continually improving the highways of the island, but transportation facilities are yet insufficient. Roads are bad, and in the rainy season they are almost impassable. Still, Cuba was twelve years ahead of the mother country, Spain, in the introduction of the railroad, the first line of about forty miles being opened in 1837, connecting Havana with Guines. By 1902 railway communication extended nearly from one end of the island to the other, and then commenced a new era of industrial and commercial opportunity. The center of the railway system is at Havana, and the principal towns and seaports of the island are connected by about 1,700 miles of

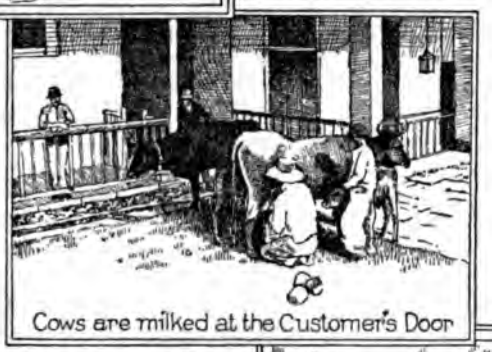
THE HOME OF A NATIVE

railway. Large sugar estates are connected with the main lines by private lines. Over 1,000 miles of cart roads are open to traffic. Two cents will carry a letter from the United States to the island.

Physical Features. In general, the eastern and western sections of this long, narrow island are mountainous, the loftiest point being Tur-



quino, which rises to a height of 8,320 feet above the eastern plateau. In the center is a region of gently-rolling plains, broken here and there by low, rounded hills, and it is here, rather than in the mountain sections, that Cuba's most picturesque scenery is to be found. The Yumuri Valley is the "show spot" of the island. Numerous streams drain the valleys and the coastal plains, but they are too rapid in the wet season and too shallow in the dry season to be of much use for navigation.


Cows are milked at the Customer's Door

Climate, Vegetation and Animals. Cuba lies just inside the torrid zone. On the coast the climate is very even, but inland it is not so equable. The coast temperature seldom drops below 65° in winter, but in the mountains the thermometer often falls lower than 50°. Coast temperature in summer is usually not higher than 90°. The average temperature for the island in January varies between 72° and 75°. The July temperature averages about 82°.

Almost everywhere in Cuba the rainfall is sufficient for agricultural purposes, only a few small areas in the interior requiring irrigation. At Havana the rainfall is over fifty inches annually, and in some northeastern sections it reaches over 100 inches. The southern coast regions have much less rainfall, however, for less moisture passes over the mountains. Rain falls throughout the year, but the chief rainy season comes in summer. During August, September and October hurricanes are liable to occur, for Cuba lies within the path of these West Indian storms. Trade winds from the northeast prevail.

Before 1901 yellow fever and other diseases were common in the lowlands, owing to unsanitary conditions. The government, acting upon measures adopted by United States military authorities during their occupation of the island, has now practically wiped out this dreaded disease.

In this warm southern land, with soil so rich that almost anything will grow, vegetation is luxuriant. Products of economic value are sugar cane, tobacco, coffee, cacao and all tropical fruits such as the banana, cocoanut, pineapple, orange, lemon, lime, date, fig, guava and pomegranate. Palms, including the useful royal palm, grow everywhere, and fields are covered with beautiful flowers and fragrant plants. In about 13,000,000 acres of forest grow some of the finest cedar and mahogany in the world, as well as such other trees of the trop-

A Cuban Courtship With Chaperon and Barred Windows

THE ISLAND OF CUBA

The large map shows the provinces, chief cities and important railroads of Cuba. The smaller one, in the corner, gives the location of the island with respect to Florida and Yucatan.

ics as the ebony, logwood and rosewood. Quail, snipe, wild turkeys, grouse, buzzards and vultures are plentiful. Hogs, dogs and cats run wild in great numbers.

Although there are but few snakes, there are a number of disagreeable forms of animal life. Among them are scorpions, centipedes and tarantulas, as well as land crabs and flying cockroaches, and worst of all, the flea which gets under the skin, called the *nigua*, or *jigger*. This is the side of life which is most irritating, both to natives and to visitors.

Cuban waters are well stocked with fish. Large sharks are common, and in coast waters the porpoise and manatee, or sea cow, are found. Crocodiles, alligators, chameleons, small lizards and tree toads are among the creeping inhabitants of this tropical land.

Agricultural Development. Previous to Cuba's last war for independence (1895-1898), the country contained over 90,000 plantations, farms, cattle ranches and orchards, valued at nearly $200,000,000. During the war many of these were completely destroyed, but after 1899 agricultural industries again developed. The simple wooden plow of four centuries ago is still in quite general use, and oxen are still the patient farm animals, yet the slowly-moving Cubans alone produce almost one-fourth the world's supply of sugar cane. The manufacture of sugar is very costly, but in 1914 there were 170 mills on the island, and about one-half the cultivated lands were given over to sugar. The yearly crop before the War of the Nations was nearly 3,000,000 tons, and the export was valued at over $100,000,000, most of which went to the United States. Then the war raised the price of sugar, and the people of Cuba planted cane in yet greater abundance. Thousands of acres which had never before been cultivated are now being used for the raising of sugar cane.

The next product in importance is tobacco, and about one-tenth of the cultivated land is given to that crop. About seventy per cent of the output is produced in the province of Pinar del Rio. Over 320,000 bales of leaf tobacco, nearly 185,000,000 cigars, about 19,000,000 packs of cigarettes and about 640,000 pounds of cut tobacco are exported from Havana yearly.

Corn, or maize, rice and sweet potatoes are raised for home use. Coffee is raised, but is not so important a product as formerly; in this industry it is becoming increasingly difficult to compete with Brazil. Fruits are easily cultivated, and fruit interests are chiefly in the hands of American companies. Almost 30,000 tons of pineapples, about 40,000 tons of bananas and over 3,000,000 cocoanuts are exported yearly.

Cattle raising is an important industry, especially in the fertile province of Camagüey. There are over 3,000,000 head of cattle on the island, and about 615,000 horses, 46,000 mules and 2,500 asses.

Manufacturing and Other Industries. The manufacture of raw sugar, cigars and cigarettes are about the only manufacturing industries of Cuba, and they are both closely connected with agriculture. Directly south of Havana, on the south coast of Cuba, at the little town of Batabano, the sponge industry is important.

Scarcity of labor is a problem which Cuba

OUTLINE AND QUESTIONS ON CUBA

Outline

I. Location and Size

(1) Latitude, 19° 40′ to 23° 13′ north
(2) Longitude, 74° to 85° west
(3) Situation with reference to other land masses
(4) Area
  (a) Actual
  (b) Comparative

II. Physical Features

(1) Coast line
  (a) Length, 2,500 miles
  (b) Numerous harbors
(2) Surface characteristics
  (a) Mountains at east and west ends
  (b) Undulating plain in center
(3) Rivers
  (a) Uselessness for navigation

III. Climate and Life

(1) Tropic conditions
  (a) Equalizing effects of sea
(2) Rainfall
(3) Unhealthfulness
  (a) Effect of sanitation measures
(4) Vegetation
(5) Animal life

IV. Industries

(1) Agriculture
  (a) Primitive methods
  (b) Chief crops
    1. Sugar cane
    2. Tobacco
    3. Coffee
    4. Fruits
  (c) Stock raising
(2) Manufacturing
  (a) Sugar
  (b) Cigars and cigarettes
  (c) Labor problems
(3) Mining
(4) Lumbering

V. The People

(1) Proportion of various races
(2) Customs and manners
(3) Religion
(4) Education
  (a) Under Spanish rule
  (b) Under present-day conditions

VI. Commerce and Transportation

(1) Commercial centers
(2) Imports
(3) Exports
(4) Railroads
(5) Highways and cart roads

VII. Government

(1) Republican form
(2) Departments and their duties
(3) Conditions of citizenship

VIII. History

(1) Discovery and settlement
(2) Repeated insurrections against Spain
(3) Interference of the United States
(4) Independence secured
(5) Recent progress

Questions

About how many miles would a letter have to travel in going from San Francisco to Cuba? How much would you have to pay to send it?

From what labor troubles have the sugar planters suffered? Why have not these affected the tobacco manufacturers as well?

To what happening did the slogan "Remember the Maine" owe its origin?

Where does it cost as much to carry a ton of freight a few rods as to carry it elsewhere a thousand miles or more? Why?

How large a part of the world's supply of sugar cane does Cuba produce?

How far is Havana from New York? from New Orleans?

What part had people from the United States taken in Cuba's fight for freedom before 1898?

Why does the Cuban milkman need no milk wagon?

Who besides a Cuban may ever become President of the republic?

What were the conditions under which the Cubans lived during the Spanish rule?

has to meet in most of its industries. The abolition of slavery in 1883 reduced the supply of black labor; the Chinese government stopped emigration of Chinese coolies to Cuba because it was said they were inhumanly treated, and the war of 1895 decreased the ranks of the laboring class. The problem is more serious to sugar planters than to manufacturers of tobacco products, for in the latter industry skilled white labor can be used.

Mineral Resources. Southeastern Cuba, near Santiago de Cuba, in the province of Oriente, is the mining section of the island. Iron, copper and manganese are the principal products. Mining interests are chiefly in the hands of American companies; most of the output is sent to the United States, and on an average 50,000 tons of iron a month are exported to that country. Gold deposits and rich beds of asphalt are not largely worked as yet.

Government. Cuba is governed in accordance with the constitution adopted by a representative convention, February 21, 1901. The government is republican in form and differs but slightly from that of the United States. The head of the administration is the President, who must be a native Cuban or a naturalized citizen who served ten years in the Cuban army during the wars of independence. He is elected by popular vote for a term of four years, and cannot serve more than two consecutive terms. He appoints and removes members of his Cabinet, who are responsible to him for the administration of their departments.

CUBAN COAT-OF-ARMS
Background of upper half is blue; lower half, green. The horseman's coat is red. The horse, clouds and cherubim are the color of silver.

Legislative power is vested in a Congress, consisting of two houses, a Senate and a House of Representatives. Four Senators from each of the six provinces form the Senate body. They are elected by a board composed of the councilmen of the province and of electors, chosen by the people, equal to twice the number of councilmen. One-half of the Senators retire every four years. The House of Representatives consists of one member for every 25,000 inhabitants or for a fraction thereof more than 12,500. They are elected for four years, one-half retiring every two years. Congress holds two annual sessions, controls the financial and foreign affairs of the republic and makes general laws for the administration of the national government, and prepares electoral laws for the provinces and municipalities.

Every male Cuban over twenty-one years of age who is mentally sound, who has not been convicted of crime and who is not serving in the army or navy, all Spanish male residents who have been on the island since April 11, 1899, and all male foreigners who have resided there since January 1, 1899, are entitled to vote. Foreigners who have taken up their residence there since January 1, 1899, are required to show five years' residence before naturalization.

History. Columbus discovered Cuba in 1492. His son Diego (James) founded Santiago de Cuba in 1514. Five years later Havana was founded. The enslavement of the native population led to its extinction in less than two generations, and negro slaves were imported from Africa. Misgovernment was the rule during nearly all of Cuba's colonial history, heavy taxes being levied upon its production and commerce for the benefit of Spain. Havana was taken by the French in 1534, and again in 1554, and in 1762 by the British in the European Seven Years' War which ended in 1763 (see SEVEN YEARS' WAR). But all these occupations were temporary.

The first insurrection of Cubans against Spain was led in 1833 by Manuel Quesada, who demanded for the island representation in the Spanish Cortes (Congress). Peace did not come until 1842, when various reforms were conceded, though representation in the Cortes was still denied. In 1850 Narciso Lopez, with 600 American filibusters, landed at Cardenas, to overthrow the colonial government; but the movement was quickly suppressed. In the next year Lopez repeated his attempt, but was defeated and executed, though his American followers were pardoned. A third filibuster in 1853 led England and France to ask from the United States a disavowal forever of an intention to take possession of Cuba, but this request was declined. The Ostend Manifesto of 1854 was not really a manifesto, but was an expression of opinion and advice by the American ministers accredited to Great Britain, France and Spain, addressed to the government of the United States, recommending it to pur-

chase Cuba from Spain or to seize the island if purchase plans should fail. Spain refused to sell the island, though offered a hundred million dollars for it; and the Manifesto was repudiated by the American people. See Ostend Manifesto.

In 1875 the United States complained to Spain that the condition of insurrection in Cuba could no longer be endured. A vigorous attempt was made by the mother country to suppress it in the following year. In 1895 a Cuban republic was proclaimed at Najassas, but the Spanish General Campos defeated the republicans at Matanzas. In the next year the cruel General Weyler succeeded Campos and angered the American people by his atrocities.

In 1898 the United States battleship *Maine,* while visiting Havana, was mysteriously blown up, supposedly by a submarine mine, though this was not known to be a fact. The press of the United States clamored for intervention in behalf of the Cubans. This action followed, and a war with Spain resulted. The Spanish force was defeated by the Americans in Cuba at San Juan Hill, near El Caney, on the 1st of July; and the Spanish fleet, which had been shut in the harbor of Santiago de Cuba, was destroyed on the third by the fleet of Admiral Sampson, who was absent at the time, the chief honor of the victory being accorded to Commodore Schley.

Peace was made in the following year, and Spanish claim to the island was forever abandoned. Cuba was recognized as a nation by the powers of the world on entering into an agreement with the United States giving the latter the right of intervention when necessary and the use of naval stations; certain stipulations were also made in 1902 as to finances and foreign relations. In 1905 intervention by the United States for the preservation of order became necessary, and the American occupation continued until 1909, when President Jose Miguel Gomez was inaugurated. He was succeeded in 1913 by Mario Menocal, a graduate of Cornell University. President Menocal was reëlected in 1916. In 1914 Cuba borrowed largely from American capitalists for the promotion of a considerable number of modern governmental enterprises.

Insurrection of 1917. When President Menocal was elected in 1916 the vote was so close between him and Alfredo Zayas that Jose Miguel Gomez, the retiring President and leader of the Zayas party, demanded that the Supreme Court reverse the result and declare Zayas elected. The demand was ignored, and Gomez threatened the government with attack and Menocal with death. The two parties may be loosely termed conservatives, under Menocal, and radicals, under Gomez.

The term of President Menocal was to expire on May 20, 1917; the radicals prepared to gather in force to seize the machinery of government and assure themselves of power to name his successor. They did not expect to become active until March, but in January the government discovered and frustrated a plot to kidnap President Menocal. Gomez and his followers escaped from Havana and scattered over the island and gathered recruits from among the discontented. They burned sugar plantations of adherents of the administration, as a means of striking at the finances of the opposition. Skirmishes which cannot be dignified as battles occurred between the regular forces of the republic and the revolutionists, in nearly all of which the former were victorious. Suspected traitors were forced from the army, four city mayors were arrested, and loyal militia companies were organized.

Meanwhile, the United States, by virtue of its right, reserved when the republic was organized, found it necessary to send the Cubans a warning that insurrection must cease; that the power of the American government would be used, if necessary, to sustain the regularly-constituted authority represented by President Menocal, and that the forthcoming elections must be held in a lawful and orderly manner. If the factions could not compose their differences intervention by the Americans for the third time would follow. E.D.F.

Consult bulletins of the Pan-American Union, Washington, D. C., sent on request; Porter's *Industrial Cuba;* Roosevelt's *The Rough Riders;* Canini's *Four Centuries of Spanish Rule in Cuba.*

Related Subjects. The following articles in these volumes contain much information which will be of help to the reader interested in Cuba:

CITIES AND TOWNS

Camagüey
Cienfuegos
Havana
Matanzas
Santiago de Cuba

HISTORY

Columbus, Christopher
Filibusters
Garcia y Iniguez, Calixto
Gomez y Baez, Maximo
Ostend Manifesto
Palma, Tomas Estrada
Spanish-American War

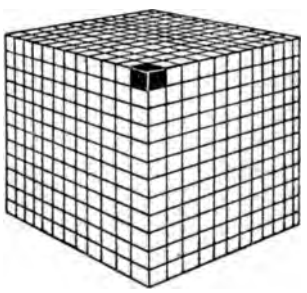
LEADING PRODUCTS

Banana
Cocoanut
Coffee
Pineapple
Sugar
Tobacco

UNCLASSIFIED

Isle of Pines

CUBE, a regular solid having six equal square faces. By *solid* is meant a body having three dimensions—length, breadth and thickness. In finding the *volume* or contents of a solid, that is, the *space* it occupies, the cube is used as a unit of measure, and the result is expressed in cubic inches, cubic feet, etc. The volume of a cube is found by using three times as a factor the number which expresses the length of one of its edges; that is, a cube whose edge is 4 inches in length contains 4×4×4, or 64, cubic inches. For this reason the third power of any number, which is the product of that number taken three times as a factor, is called its cube; for example, the cube of 2 is 8; the cube of 3 is 27. For practical application of the theory of the cube and its relations, see CUBIC MEASURE; MENSURATION.



A CUBE

The figure, reduced in size, represents a cubic foot. Each face is twelve inches in length and width. The volume is 12×12×12 inches, or 1,728 cubic inches. The small black cube is one-twelfth of the length, breadth and thickness, or one cubic inch. There are 1,728 such small cubes in the entire body.

CUBEBS, *ku'bebs*, the dried, unripened berries of a shrub belonging to the pepper

PARTS OF CUBEB PLANT

(*a*) Branch; (*b*) flower; (*c*) berry growing from flower stalk.

[redacted], the *piper cubeba*. It is used in Eastern [redacted] as a flavoring and in Europe and [redacted] for medicinal purposes. The shrub is native to Penang, Sumatra, New Guinea and neighboring islands. The dried berries look much like black pepper, but are less pungent and of more agreeable flavor than that spice. The drug prepared from cubebs acts as a stimulant and is sometimes used in treating indigestion. When prepared in the form of cigarettes cubebs are sometimes thought to afford relief for hay fever, asthma and inflammation of the pharynx.

CUBE ROOT. When it is desired to find the length of one of the sides of a cube, that fact is usually ascertained by actual measurement. If, however, the number of cubic units in the volume of the cube is known, the length of any side may be found by figuring the *cube root* of the number representing the volume. The cube root of a number is one of its three equal factors, as illustrated below. The knowledge of how to find the cube root of large numbers is not of great practical importance to the average person, but such problems have considerable value for mental discipline, and they are interesting exercises to anyone with a taste for mathematics. We will begin this subject with a study of the roots of small numbers:

$2\times2\times2=8$; 8 is the *cube* of 2, and 2 is the *cube root* of 8.

$12\times12\times12=1728$; 1728 is the *cube* of 12, and 12 is the *cube root* of 1728.

The cube of 6 is written 6^3. The small figure 3 is called the *exponent*.

The cube root of 216 is written $\sqrt[3]{216}$. The $\sqrt{\ }$ is called the *root sign*, or *radical sign*.

How to read the indicated operations:

I. 6^3 may be read in full, as follows:

(a) Multiply 6 by 6, and that product by 6;
(b) Use 6 as a factor 3 times;
(c) The third power of 6;
(d) The cube of 6;
(e) 6 cubed.

II. $\sqrt[3]{64}$ is read as follows:

(a) What number used as a factor 3 times gives 64? It can be seen clearly this way: $n\times n\times n=64$. What is n?

(b) Cube root of 64.

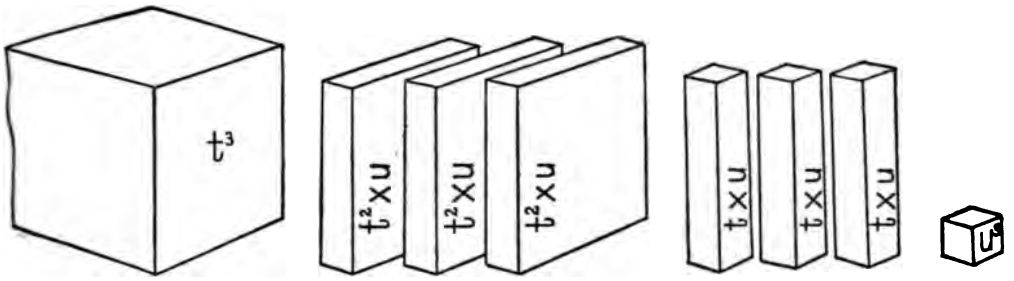
It may be written $n^3=64$ and read, "What number cubed gives 64?" This use of n should be common in the arithmetic class; it is very helpful in making things clear, but should be read "number" or "what number," not read "n."

Exercise in reading:

(1) $4^3=4\times4\times4=64$.
(4 used as a factor three times is $4\times4\times4=64$.)

(2) $6^3=6\times6\times6=216$.
(6 cubed is $6\times6\times6=216$.)

(3) $8\times8\times8=8^3=512$.
$9\times9\times9=9^3=729$.
(Read just as they appear.)



PARTS OF A CUBE

Fig. *a*, at left, represents the cube of the tens; Fig. *b*, left center, the square of the tens times the units, taken three times; Fig. *c*, right center, the tens times the units, taken three times; Fig. *d*, at right, the cube of the units.

(4) $n \times n \times n = 27$.
What number used as a factor 3 times gives 27?

(5) $n \times n \times n = 216$;
$n = 6$.
6 used 3 times as a factor gives 216 or $6 \times 6 \times 6 = 216$.

(6) $n^3 = 27$;
$n = 3$.
This is read, "What number cubed gives 27?"
"3 cubed gives 27, or,
$3 \times 3 \times 3 = 27$."

(7) $\sqrt[3]{27} = 3$.
This is read, "The cube root of 27 is 3."

Cube and Cube Root of Common Fractions. Following are examples illustrating this phase of cube root:

$\left(\frac{1}{2}\right)^3 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$.

$\sqrt[3]{\frac{1}{8}} = \frac{1}{2}$.

$\left(\frac{2}{3}\right)^3 = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \frac{8}{27}$.

$\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$.

$\left(\frac{4}{5}\right)^3 = \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}$.

$\sqrt[3]{\frac{64}{125}} = \frac{4}{5}$. Proof: $\frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}$.

$\sqrt[3]{\frac{27}{64}} = \frac{3}{4}$ Proof: $\frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{27}{64}$.

$\sqrt[3]{\frac{8}{125}} = \frac{2}{5}$ $\frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} = \frac{8}{125}$.

$\sqrt[3]{\frac{125}{216}} = \frac{5}{6}$ $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} = \frac{125}{216}$.

$\sqrt[3]{\frac{27}{1000}} = \frac{3}{10}$ $\frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} = \frac{27}{1000}$.

The cubes of the tens from 10 to 90 can be easily learned by memorizing the cubes from 1 to 9.

$1^3 = 1$.	$10^3 = 1000$.
$2^3 = 8$.	$20^3 = 8000$.
$3^3 = 27$.	$30^3 = 27000$.
$4^3 = 64$.	$40^3 = 64000$.
$5^3 = 125$.	$50^3 = 125000$.
$6^3 = 216$.	$60^3 = 216000$.
$7^3 = 343$.	$70^3 = 343000$.
$8^3 = 512$.	$80^3 = 512000$.
$9^3 = 729$.	$90^3 = 729000$.

Cube and Cube Root of Decimal Fractions. The cube of the decimal fraction offers no new difficulty. A product contains as many decimal places as all its factors contain; for example, $.6 \times .6 \times .6 = .216$. Therefore, from the above we have:

$.1^3 = .001$.	$.01^3 = .000001$.
$.2^3 = .008$.	$.04^3 = .000064$.
$.3^3 = .027$.	$.09^3 = .000729$.
$.5^3 = .125$.	
$\sqrt[3]{125} = 5$.	$\sqrt[3]{729} = 9$.
$\sqrt[3]{.125} = .5$.	$\sqrt[3]{.729} = .9$.
$\sqrt[3]{.000125} = .05$.	$\sqrt[3]{.000729} = .09$.

In all the above problems it is possible to get the cube root at sight or by a little careful inspection.

Cube Root by Factoring. The next simple method is that of factoring where the three equal factors are not so apparent. For example:

(1) $\sqrt[3]{15625} = n$.
$15625 = 5 \times 5 \times 625$.
$5 \times 5 \times 625 = 5 \times 5 \times 5 \times 125$.
$5 \times 5 \times 5 \times 125 = 5 \times 5 \times 5 \times 5 \times 25$.
$\sqrt[3]{15625} = 25 \times 25 \times 25$.

(2) $\sqrt[3]{4096} = n$.
$4096 = 4 \times 1024$.
$4 \times 1024 = 4 \times 4 \times 256$.
$4 \times 4 \times 256 = 4 \times 4 \times 16 \times 16$.
$\sqrt[3]{4096} = 16 \times 16 \times 16$.

We can find the cube root of an indicated product by factoring. For example, "What is the edge in inches of a cubic space whose capacity is 8 cubic feet?"

Volume in cubic inches $= 8 \times 1728$.
Edge in inches $= \sqrt[3]{8 \times 1728} =$
$7\sqrt[3]{(2 \times 2 \times 2) \times (12 \times 12 \times 12)}$.
Edge in inches $= 2 \times 12 = 24$.

$\sqrt[3]{27 \times 216} = \sqrt[3]{3 \times 3 \times 3 \times 6 \times 6 \times 6} = 3 \times 6 = 18$.

$\sqrt[3]{512 \times 343} = 8 \times 7 = 56$.

$\sqrt[3]{729 \times 125} = 9 \times 5 = 45$.

The above problems are all solved more or less freely by inspection.

Cube Root of Numbers Consisting of 10's and Units. We shall see first how such numbers are cubed and of what their cubes consist; then we can understand how to find the cube root of a number.

Let us cube 26.

$26 = 20 + 6.$

$26^3 = (20+6)^3$, or

$26^3 = (20+6) \times (20+6) \times (20+6).$

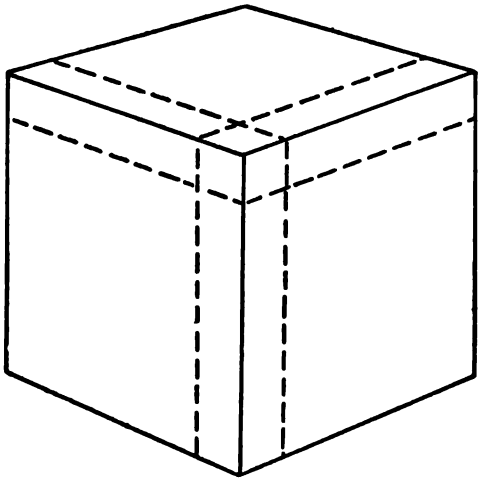
$$\begin{array}{l} 20 + 6 \\ 20 + 6 \\ \hline 20^2 + (20\times 6) \\ \quad + (20\times 6) + 6^2 \\ \hline 20^2 + 2\times(20\times 6) + 6^2 \\ \qquad\qquad 20 + 6 \\ \hline 20^3 + 2\times(20^2\times 6) + \quad (20\times 6^2) \\ \qquad (20^2\times 6) + 2\times(20\times 6^2) + 6^3 \\ \hline 20^3 + 3\times(20^2\times 6) + 3\times(20\times 6^2) + 6^3 \end{array}$$

Therefore:

$$26^3 = 20^3 + (3\times 20^2\times 6) + (3\times 20\times 6^2) + 6^3.$$

Translating this into words, we have: "The cube of a number is made up of the cube of the tens, and 3 times the square of the tens times the units, and 3 times the tens times the square of the units, and the cube of the units."

The figure below shows these parts together as the *whole cube*.



$$t^3 + 3(t^2 u) + 3(t u^2) + u^3$$

THE COMPLETED CUBE

Following this truth we write out the cube of 38, and have: $38^3 = 30^3 + (3\times 30^2\times 8) + (3\times 30\times 8^2) + 8^3$.

Putting the general truth into concise form, we have: $(\text{tens}+\text{units})^3 = \text{tens}^3 + (3\times\text{tens}^2\times\text{units}) + (3\times\text{tens}\times\text{units}^2) + \text{units}^3$.

Or, using t for tens and u for units, we have:

$$(t+u)^3 = t^3 + (3\times t^2\times u) + (3\times t\times u^2) + u^3.$$

From this we are able to find the cube root of a number, as below:

Let us take 941192. Some number has been cubed to give this. It is indicated thus:

$n^3 = 941192$

$n = \sqrt[3]{941192}.$

The process of finding the cube root:

$$\begin{array}{l|l} & 90+8 \\ & 941192 = t^3 + (3\times t^2\times u) + (3\times t\times u^2) + u^3 \\ & \underline{729000 = t^3} \\ 3\times 90^2 = & 212192 = (3\times t^2\times u) + (3\times t\times u^2) + u^3 \\ 24300 & 194400 = 3\times t^2\times u \\ \hline & 17792 = (3\times t\times u^2) + u^3 \\ & 17280 = 3\times t\times u^2 \\ \hline & 512 = u^3 \\ & 512 = 8^3 \\ & \underline{\quad} \end{array}$$

"What is the largest cube of tens in the number?" Thinking of 941000 (which contains the 10's cubed) as 941, we find 729, or 9^3, the largest cube. Nine is the cube root of this, but 9 tens is 90, and $90^3 = 72900$, which we take out; the remainder, 212192, must contain the rest of the cube, namely $(3\times t^2\times u) + (3\times t\times u^2) + u^3$. Since the first term, $3\times t^2\times u$, is much the largest part of the remainder, we may for the moment consider $212192 = 3\times t^2\times u$. We have the product of three numbers and have two known numbers, 3 and 90^2, to find u, the one not known, as expressed in the following:

$$212192 = 3\times 8100\times u.$$

Therefore, to find u, we divide 212192 by 24300, and find $u = 8$. Now we take out $3\times t^2\times u$ or $3\times 90^2\times 8$, and have left 17792, which must contain $(3\times t\times u^2) + u^3$, the rest of the cube. We take out $3\times t\times u^2$ or $3\times 90\times 64$ or 17290, and have left 512, which equals 8^3 or u^3. So we have found that 941192 is the cube of 98 or $\sqrt[3]{941192} = 98$. This is the simplest method for those not familiar with algebra. For more advanced students the problem may be worked as follows:

$$\begin{array}{l|l} & 90+8 \\ & \overline{941192} = t^3 + 3t^2u + 3tu^2 + u^3 \\ & 729000 = t^3 \\ 3t^2 = 24300 & 212192 = (3t^2 + 3tu + u^2)\,u \\ 3tu = \quad 2160 & 212192 \\ u^2 = \quad\ 64 & \underline{\quad} \\ \quad 26524 & \end{array}$$

First find the largest cube of tens, which is seen to be 729, and the cube root, 9 tens or 90; take out 90^3, and there is left 212192, which must contain the other three terms of the cube; that is,

$$212192 = 3t^2u + 3tu^2 + u^3, \text{ or,}$$
$$212192 = (3t^2 + 3tu + u^2)\,u.$$

Since $3t^2u$ is much the largest part of the three quantities, we may for a moment neglect the other two and have $212192 = 3t^2u$. We have the product of three numbers and two of them given to find the third. We find u by dividing 212192 by 3×90^2 and get $u = 8$. Then we substitute 90 for t and 8 for u in each part inside the parentheses and get the entire divisor as shown, 26524. This multiplied by u, or 8, gives 212192. This shows that we find in 941192 the cube of 98. Therefore, 98 is the cube root of 941192, or $\sqrt[3]{941192} = 98$.

The usual method followed after the subject is understood is given below accompanied by an illustration:

$\sqrt[3]{373248}=n$

		72	
		373248	
		343	
3×70^2	$=14700$	30248	
$3\times70\times2=$	420	30248	
	4		
	15124		

Separate the number into periods of three digits each, beginning at the right. Find the largest cube in the first period, 373. It is 343. Place its cube root, 7, in the answer. Subtract the largest cube, 343, and bring down the next period. Divide the remainder by three times the square of the tens (in this case $3\times70^2=14700$), and place the quotient (2 in this case) in the answer beside the number already there; in this case this gives 72 in the cube root. Then add to the trial divisor (as $3\times\text{tens}^2$ is called) three times the tens times the units, which in this case is $3\times70\times2=420$, and add also the square of the units, which in this case is 4. Then multiply the sum of these three, which is the real divisor, in this case 15124, by the units, which in this case is 2, and place the product under the dividend. The product, 30248, is the same as the dividend, and 72 is the cube root of 373248.

Another illustration, when there are three digits in the root:

$\sqrt[3]{187149248}=n.$

		572	
		187149248	
		125	
$3\times50^2=$	7500	62149	
$3\times50\times7=$	1050		
$7^2=$	49	60193	
	8599	1956248	
3×570^2	$=974700$		
$3\times570\times2=$	3420		
$2^2=$	4	1956248	
	978124		

The only new point in this problem is that 57 becomes the tens at the second division, and the divisor, $3\times\text{tens}^2$, becomes 3×570^2.

Cube Root of Decimals. In taking the cube root of a number containing a decimal, we separate it into periods, beginning at the decimal point, and marking off into periods of three digits each, to the left for the whole number and to the right for the decimal, as,

67'842.368'795.

If the decimal part has not 3, 6, or 9, etc., places, zeros are added, as:

32.687'49.
32.687'490.

The cube root of a decimal has ⅓ as many decimal places as the cube has. The cube is the product of three equal factors; therefore, it contains three times as many decimal places as the cube root. If a given number is not a perfect cube, annex decimal zeros, in groups of threes; carry it out as many decimal places as is desired. For example:

$\sqrt[3]{750}=\sqrt[3]{750.000'000'000.}$

which will give the cube root to three decimal places.

Cube Root of Common Fractions. This is touched upon in the early part of the article, but we shall generalise it here:

$$\left(\frac{7}{8}\right)^3=\frac{7}{8}\times\frac{7}{8}\times\frac{7}{8}=\frac{7^3}{8^3}=\frac{343}{512}.$$

Therefore, $\sqrt[3]{\frac{343}{512}}=\frac{\sqrt[3]{343}}{\sqrt[3]{512}}=\frac{7}{8}.$

The cube root of a common fraction is a fraction whose numerator is the cube root of the numerator of the first fraction, and whose denominator is the cube root of the denominator of the first fraction, as,

$$\sqrt[3]{\frac{216}{343}}=\frac{\sqrt[3]{216}}{\sqrt[3]{343}}=\frac{6}{7}\qquad\sqrt[3]{\frac{a^3}{n^3}}=\frac{\sqrt[3]{a^3}}{\sqrt[3]{n^3}}=\frac{a}{n}.$$

A.H.

CUBIC, *ku'bic,* **MEASURE,** the system used in the measurement of solids, that is, bodies having the three dimensions of length, breadth and thickness. It derives its name from the cube, which is the unit of measure employed in finding the contents, or volume, of solids (see CUBE). The volume of a regular solid is found by multiplying together the numbers representing its three dimensions.

Practical Applications. The following table, which should be memorised, contains the values commonly used in the solution of problems based on the cube:

1728	cubic inches (cu.in.)	=1 cubic foot (cu. ft.).
27	cubic feet	=1 cubic yard (cu.yd.).
231	cubic inches	=1 gallon.
2150.4	cubic inches	=1 bushel.
24¾	cubic feet	=1 perch of stone.

(a) How many cubic yards will be taken out in digging a cellar 15 feet wide, 40 feet long and 8 feet deep?

(b) What will it cost to build a stone wall 30 rods long, 3½ feet high and 1 yard thick, at $6.50 a perch?

(c) How many bushels of oats will a bin hold which is 2 yards long, 2½ feet wide and 5 feet, 4 inches high? How many gallons of water would a tank of equal size contain?

Short Methods. The following rules will be found helpful in the quick solution of various practical problems:

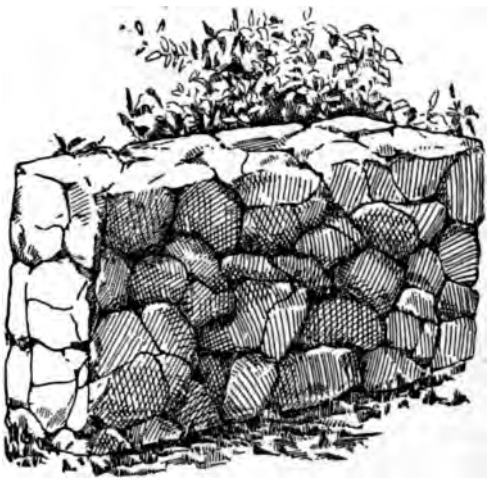
(1) To find the number of cubic feet in a log multiply one-fourth of the average circumference by itself and multiply the product obtained by the length, which will give the contents in cubic feet.

(2) A full-sized cord of wood is a solidly-built pile 8 feet long, 4 feet wide and 4 feet high, containing $8\times4\times4$, or 128, cubic feet.

(3) A cord of stone will make approximately 100 cubic feet of wall.

(4) Three bushels of lime and one cubic yard of sand will lay a cord of stone.

Practical Problems. (a) How many cubic feet are there in a log 40 feet long, 15 inches in diameter at one end, and 18 inches at the other? (To find the circumference at each end, use the rule: The circumference of a circle is equal to 3.1416 times the diameter.)



A CORD OF STONE

Solution of (a). 15 inches = 1¼ feet. 18 inches = 1½ feet. Circumference of log at smaller end = 3.1416 × 1¼ feet = 3.927 feet. Circumference of log at larger end = 3.1416 × 1½ feet = 4.7124 feet. Average circumference = ½ (3.927 + 4.7124) feet = 4.3197 feet. Contents of log in cubic feet $= 40 \times 4.3197 \times \frac{4.3197}{4} = 186.598$.

(b) In stove-wood measure, each stick is 16 inches long. How many cords of stove wood could be made from a full-sized cord of wood?

(c) If the full cord is bought for $3.00 and sawed into stove lengths as in problem (b) and sold for $1.25 a cord, what is the profit?

Solution of (b) and (c). Since the full-sized cord is 4 feet (48 inches) wide, as many cords of 16-inch wood can be made from it as 48 ÷ 16, or 3. The stove wood is sold for 3 × $1.25 or $3.75. The profit is therefore $3.75 − $3.00 or $.75.

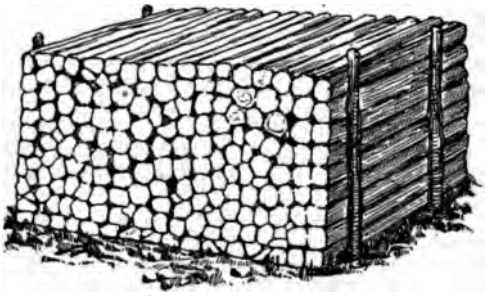
Measures for Crops. (1) A ton of dry hay is estimated at 500 cubic feet to the ton. To find the number of tons in a mow, multiply the length in feet by the height in feet and then by the width in feet and divide the result by 500.

(2) To find the number of tons in a stack, multiply the width in feet by the length in feet by ⅓ the height and divide by 500.

(3) To find the contents of a round stack, multiply the distance around the stack in feet by itself and then multiply by 4 times the height in feet, striking off two places from the right of the result thus obtained. This gives the number of cubic feet in the stack, and by dividing by 500, the number of cubic feet occupied by a ton of dry hay, the number of tons is found. If the dimensions of the stack are given in yards the same process should be followed, except that at the end the cubic contents of the stack should be divided by 18.5 instead of 500. There are 18.5 cubic yards in the space occupied by a ton of hay.

(4) To find the contents of a crib in bushels of shelled corn, multiply the number of cubic feet in the crib by 8 and strike off the right-hand figure; that is, divide by 10. This is equivalent to eight-tenths of the number of cubic feet in the crib. One cubic foot of space holds eight-tenths of a bushel of shelled corn.

(5) To find the number of heaped bushels of ear corn contained in a crib, multiply the number of cubic feet in the crib by 4 and strike off the right-hand figure. This is equivalent to taking four-tenths of the number of cubic feet, and is correct because one cubic foot holds about four-tenths of a bushel of ear corn.



A CORD OF WOOD

(6) When the sides of the crib are flared, that is, wider at the top than at the bottom, it is necessary to take the average width in estimating. Take one-half the sum of the top and bottom widths as the average. Multiply this figure by the height, and then multiply by the length. The result will be the cubic area of the crib. Then, to find the number of bushels of ear corn, multiply this result by 4 and strike off the right-hand figure.

A CORN CRIB

If this structure is eight feet wide at the top of the door and five feet wide at the bottom, the average width is six and one-half feet.

Practical Problems. (a) How many tons of hay are there in a mow 30 feet long, 10 feet high and 20 feet wide?

Solution of (a). $30 \times 10 \times 20 = 6{,}000$, number of cubic feet in the mow. $6{,}000 \div 500 = 12$, number of tons.

(b) A stack is 20 feet long, 10 feet high and 15 feet wide. How many tons does it contain?

(c) How many tons in a circular stack 20 yards around and 5 yards high?

(d) A crib 18 feet long, 18 feet high and 8 feet wide is filled with shelled corn. How many bushels does it hold?

Solution of (d). $18 \times 10 \times 8 = 1{,}440$, number of cubic feet in crib. $1{,}440 \times 8 = 11{,}520$. Striking off the right-hand figure we have 1,152, number of bushels the crib will hold. B.M.W.

CUBIST SCHOOL OF PAINTING, a school of modern art, whose adherents prefer symbols to realities. It dates from 1913 and is the aftermath of the Post-Impressionist Movement (see IMPRESSIONIST SCHOOL OF PAINTING). By means of geometric figures, cubes, triangles and parallelograms the Cubist aims to produce an abstract sensation upon the mind of the observer of his work. As one critic has said: "He takes the elements of expression from the forms and colors of nature and uses them not to represent objects but to produce an organism which will contain in terms of art what a given subject means to him in terms of sensation."

The Cubist has shown the possibility of an expression in painting without representation, a process familiar for centuries in music; in fact, the Cubist believes that the painter can do with line and color what the composer does with sound, stating his belief in these words: "If a musician composes a pastoral symphony he does not imitate the mooing of cows, the bleating of sheep and the rippling of brooks. Therefore, if I paint a pastoral symphony, why should people insist upon seeing in my painting that which they cannot hear in the music of Mozart or Beethoven?" His art, therefore, largely makes its appeal to the psychological faculty of man by means of the artist's own particular code of signs and symbols. The Cubist demands an independent right to express himself as he wishes in each canvas and to paint an apparent mood as freely as does the poet or musician.

Paul Picasso is the founder and leading exponent of Cubism; one of his most famous paintings is *The Woman with the Mustard Pot.* Other noted followers are Marcel Duchamp, noted for his *Nude Descending a Staircase;* and Francis Picabia, represented by his *The Dance at the Spring.* Just what the effect of this new tendency in art will have upon the future it is too early to predict, but it is apparently a transient vagary. R.D.M.

CUCKOO, *kuck'oo,* a bird known in Europe as the "darling of the spring." There are nearly 200 known species, common in warm countries. The two commonest in the United States and Eastern Canada are the black-billed and the yellow-billed cuckoos, yet even they are not as familiarly known as many other birds, and their note is a rather harsh *kuk kuk,* unlike the sweet tones of the European species, which gave the bird its name. The song of the cuckoo has inspired many poets.

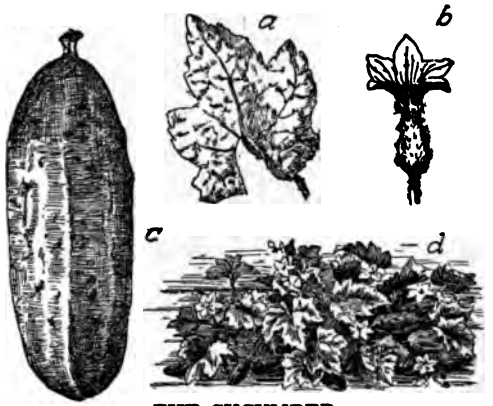
THE CUCKOO

The two American species of cuckoo are slender, about a foot in length, with long, rounded tails and long, sharp, arched bills. Their toes, two pointing forward and two backward, are especially adapted to clinging rather than to climbing. Their feathers are a beautiful olive-brown, with a bronze tint. The chief difference in the two species is in the color of bill; however, the black-billed species has red circles about its eyes and the yellow-billed has white "thumb-nail" marks on its tail. In the Middle, Western and Southern states the yellow-bill is known as the *rain-crow,* as it is believed when its call is heard it is a sign of rain. Perhaps the reason for this is that cuckoos delight in damp, cloudy weather. The European cuckoo has ashy-gray plumage, barred with black beneath, and its tail is marked with white.

The favorite home of the cuckoo is near running water. It eats insects and hairy caterpillars, and so is of benefit to man. Mulberries, too, are eaten greedily by these woodpeckerlike birds. Cuckoos lay from two to five pale green-blue, unpolished eggs. The American species builds a rather untidy nest and hatches its own eggs, but the European cuckoo lays its one small egg on the ground, then picks it up and deposits it in the nest of another bird, where the unwilling mother cares

for it (see COWBIRD). The day before the young cuckoo leaves the nest it is covered with sharply-pointed pin feathers, and looks like a little porcupine, but in twenty-four hours it has a coat of soft, beautiful feathers.

CUCUMBER, *ku'kum ber,* a garden vegetable, oblong and oval in shape, used green as a salad and for pickling. It probably originated in Northern India at least three thousand years ago; since that time it has passed from country to country and is now widely cultivated in nearly every part of the temperate zones.



THE CUCUMBER
(*a*) Leaf; (*b*) flower; (*c*) fruit; (*d*) vine.

The melonlike vine which bears the fruit has a rough trailing stem with tendrils for climbing, hairy leaves with three to five pointed lobes, and short-stalked, yellow, bell-shaped flowers, the male and female flowers both on the same vine. The vegetable itself, according to the species, grows from four to thirty inches long. It contains numerous flattened seeds in a somewhat watery pulp. Cucumbers are picked for use before ripe, for if allowed to turn yellow and to ripen they are tough and very full of seeds. Like tomatoes, they are soaked in water before peeling, then thick pieces are removed from the ends and sides, as the skins contain unwholesome juices. After the peeled portion is sliced, salting removes more of the undesirable juice and makes the cucumbers more digestible. Served as a salad with cream dressing, the vegetable is as nutritious as fresh celery. Small cucumbers used for pickling are sometimes called *gherkins.*

Cucumbers require a rich, moist, warm loam, and as they are very sensitive to frost they are often grown under glass to supply the early summer demand. Indoors the seed should be planted in March, outdoors from April to July, one-half ounce of seed being required for 100 feet. The seed should be planted one inch deep. It is usually planted in little hills, enriched with well-rotted manure, and about six feet apart each way. The plants are subject to a number of diseases and insect pests, but these can be checked by careful use of fungicides and poisons (see INSECTICIDES AND FUNGICIDES).

CULLOM, *kul'um,* SHELBY MOORE (1829-1914), an American statesman whose career is fittingly summarized in the title of the book which he published in 1911, three years before his death—*Fifty Years of Public Service.* He was born in Wayne County, Ky., was admitted to the bar in 1855, and began the practice of law at Springfield, Ill. Becoming an active leader in Illinois politics, he was several times elected to the state legislature, and sat in the national House of Representatives for three terms after 1865. As a delegate to the National Republican Convention of 1872 he placed General Grant in nomination for the Presidency. Between 1876 and 1883 he was governor of Illinois, in the latter year entering the United States Senate as a Republican. To this body he was reëlected for every term until the one beginning in 1913. Cullom was the author of the Interstate Commerce Law and served for many years as chairman of the Senate Committee on Interstate Commerce. In 1898 he was one of the commissioners to establish American government in Hawaii.

In 1913 he accepted his last public appointment, that of commissioner in charge of the Lincoln Memorial at Washington, D. C. No other service could have been more pleasing to him than this, for he was one of Lincoln's personal friends.

CUMBERLAND, *kum'ber land,* MD., the county seat of Allegany County, noted chiefly for its large coal interests. It is situated in the extreme northwestern section of the state, on the Potomac River and on the Chesapeake and Ohio Canal. Pittsburgh is 150 miles northwest; Baltimore and Washington are respectively 178 and 152 miles southeast. Railway transportation is provided by the Baltimore & Ohio, the Cumberland & Pennsylvania, the Pennsylvania and the Western Maryland railroads. Cumberland was founded in 1785 on the site of Fort Cumberland, which was built in 1754-1755; the town was incorporated in 1815 and became a city in 1850. It was the first city in Maryland to adopt the commission form of government (1909). In population it is second in the state, ranking next to Baltimore;

the Census Bureau estimate of 26,074 in 1916 showed an increase of 4,235 since 1910.

Cumberland occupies a site 700 feet above tide-water in a locality noted for picturesque scenery. Besides possessing scenic beauty, this district is rich in coal deposits, great quantities of the semi-bituminous variety being shipped from Cumberland. Manufacturing, in which large capital is invested, is represented by steel mills, iron foundries, cement works, tanneries, glass works and large rolling mills engaged in making railway supplies.

CUMBERLAND, R. I., a town in the extreme northeastern part of the state. The population increased from 10,107 in 1910 to 10,848 in 1916. The town is situated near the Pawtucket and Seekonk rivers, in Providence County, six miles north of Providence and thirty-eight miles southwest of Boston. Three branches of the New York, New Haven & Hartford Railroad serve the city, and electric lines connect with towns north and south. The town was settled in 1646, was incorporated in 1747, and was named for Cumberland, England.

Beautiful hills and wooded districts surround Cumberland, and coal, copper, gold and granite are found in the vicinity. The interests of the town are largely centered in the manufacture of cotton, silk and horseshoes. A Carnegie Library adds to the educational advantages of the public school system, which has fifteen elementary schools and a high school. The only Cistercian Trappist Monastery in New England is located here.

CUMBERLAND MOUNTAINS, the name given that division of the Appalachian Mountain system which extends across the eastern part of Tennessee and forms the boundary between Virginia and Kentucky. The region covered by the division is a plateau about 2,000 feet high and fifty miles wide, on which rise several ranges of hills or low mountains to the height of 500 or 600 feet. The slopes of the plateau are steep. The region is covered with forests of chestnut, oak, ash and other hard woods. An opening through these mountains where Kentucky, Virginia and Tennessee meet is the celebrated "Cumberland Gap," through which early settlers wended their way westward into Kentucky and Tennessee, and which was traversed by both the Confederate and the Union forces during the War of Secession.

CUMBERLAND RIVER, a large tributary of the Ohio River, which rises in the highlands in Southeastern Kentucky, flows westward into Tennessee, and after making almost a half-circle in that state, returns to Kentucky and mingles its waters with those of the Ohio, near Smithland. Its winding course is 688 miles in length, and its drainage basin is over 18,000 square miles in area. At the Great Falls, in Whitley County, Ky., the river makes a sudden descent of sixty-three feet; below the falls the stream plunges over a series of rapids, the Great Shoals, for a distance of ten miles, descending to a level course between beautiful bluffs that gradually decrease in height. When conditions are favorable the Cumberland is navigable for light steamers carrying local products and merchandise as far as Burnside, Ky., 518 miles from its mouth, and steamers go to Nashville, a distance of 193 miles, throughout the year.

During the War of Secession the Confederates erected Fort Donelson on the Cumberland, and near-by, Fort Henry, on the Tennessee. The capture of these two forts in 1862 by Commander Foote and General Grant was one of the most important Union victories of the year.

CUMBERLAND ROAD, a government highway, called also the NATIONAL ROAD, and known at first as the GREAT NATIONAL PIKE. It was projected in response to a demand for a better route from the East to the West, in view of

MAP OF THE CUMBERLAND ROAD

rapid settlement beyond the Ohio River. As finally built, it extended from Fort Cumberland, on the Maryland frontier, to Vandalia, Ill., a distance of 800 miles. As it was for many years the chief line of travel for thousands of Eastern settlers who were making their way westward, the Cumberland Road was an important factor in the development of the West and Southwest. The original plan was to construct the road from funds obtained by the sales of public lands in the states through which it passed, but it soon became necessary to call on Congress for additional appropriations, and between 1806, the year in which construction work began, and 1838 there were voted sums amounting to $6,821,246.

It was largely due to the efforts of Henry Clay that Congress advanced this money, and

[illegible] of his services a monument [illegible] on the road near Wheel- [illegible] Because of the increasing [illegible] railroads in stimulating west- [illegible] construction work on the [illegible] was stopped in [illegible] states through which [illegible] given control of that [illegible]

[illegible] an [illegible] one of [illegible] the Re- [illegible] of Iowa [illegible] from that [illegible]

[illegible] B. CUMMINS

[illegible] practiced in Chicago [illegible] Moines, which became [illegible] was soon conspicuous as a [illegible] campaign organizer. He [illegible] at-large, chairman of [illegible] convention and delegate [illegible] convention in 1892, and there- [illegible] at nearly every state and [illegible] of his party. He was [illegible] considered as a candidate for [illegible] and in 1912 sought the nomina- [illegible] He refused to leave the [illegible] party in that year, although he [illegible] sympathy with the Progressive [illegible] opposed the methods by which [illegible] was renominated.

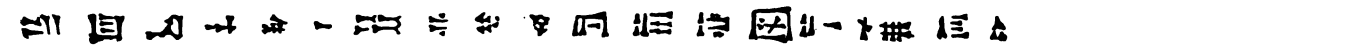
[illegible] first became a national figure about [illegible] as the chief sponsor of the "Iowa idea," which called for a reduction in the existing high tariffs. In Iowa he was the leader of the progressive Republicans who opposed the Conservatives led by Senator William B. Allison. In 1902, 1904, 1906 and again in 1908 he was elected governor, but resigned a month before [illegible] of his third term in order to become [illegible] Senator, filling out the unexpired [illegible] Allison. He made a thorough study of railroad regulation and the control of other corporations, and his terms as governor were noteworthy for advanced trust legislation. In the Senate he became one of the leaders of a steadily-growing number who sought and secured progressive legislation.

CUNEIFORM, *ku ne' i form,* **INSCRIPTIONS,** the name given to the wedge-shaped characters used in one of the earliest forms of writing known to man. *Cuneiform* is from the Latin word *cuneus,* meaning *a wedge.* This system of writing originated in Babylonia at a remote and unknown date, and was invented by a primitive race of people called Sumerians, who developed it from a crude form of picture-writing. From stone they turned to clay as a writing material, using a sharp-pointed instrument, or *stylus,* which was triangular in shape, and which made wedgelike impressions in the soft clay. In this way cuneiform characters originated. Adopted by the Semitic Babylonians about 4500 B.C., cuneiform writing was taken over by the Assyrians and other peoples of Western Asia and by the Egyptians, and was in use until the first century before the Christian Era. The inscriptions were made both on clay tablets and on stone.

MEANING	Outline Character 4500 B.C.	Cuneiform 2500 B.C.	Assyrian 700 B.C.	Babylonian 500 B.C.
The sun				
God, heaven				
Mountain				
Man				
Ox				
Fish				

EXAMPLES OF CUNEIFORM WRITING

Each sign employed consists of a wedge or a combination of wedges written from left to right. The wedge points to the right, downwards or aslant, and sometimes two are joined to form an angle. Cuneiform writing is difficult to translate, because a character may represent a whole syllable or a word, and the system is therefore extremely complicated. Of the various forms of this writing the Persian is the simplest, because each sign stands either for a word or for a consonant and a vowel. The Assyro-Babylonian system is the most



CUNEIFORM CHARACTERS

The above, translated, reads: "She put me in a basket of rushes; with pitch my door she shut."

complicated and also the most important, because of what it has revealed to the modern world of the history of the ancients, and especially of peoples mentioned in the Bible.

Though Herodotus, Plutarch and other ancient writers referred to cuneiform texts, they seem to have passed out of the remembrance of man until the fifteenth century, when European travelers became interested in the famous inscription of Darius, carved 300 feet above the ground on the steep side of Behistun Rock, in Western Persia. On this lofty cliff Darius had recorded his achievements in three languages, Persian, Susian and Babylonian. The deciphering of the Persian text was begun in 1802 by a German scholar, Georg Grotefend, who succeeded in making out the name Darius. In 1838 Sir Henry Rawlinson made an epoch-making translation of a considerable portion of the Persian inscription, and six years later the translation of the Susian text was begun by Westergaard. Other scholars, including Rawlinson, succeeded in interpreting the Babylonian inscriptions, and since then marked progress has been made in this field of investigation. There are, however, thousands of cuneiform texts yet to be deciphered. B.M.W.

CUPID, *ku'pid,* the god of love of classic mythology, represented in sculpture and painting as a beautiful, chubby, naked boy with gauzy wings and a roguish, dimpled face, and armed with a bow and a quiver of arrows. No other character of mythology has been adopted more generally into the literature and sentiment of the present day. Frequently mentioned as *Dan Cupid,* this "archer of archers" is usually spoken of as blind or blindfolded. Shakespeare in *Midsummer Night's Dream* says:

"Love looks not with the eyes, but with the mind;
And therefore is winged Cupid painted blind."

Cupid was the son of Mars, god of war, and of Venus, the goddess of love. The legend is that he loved a mortal princess named Psyche, who after many trials was made immortal by the gods. As Cupid is the emblem of the heart, Psyche is the symbol of the soul.

Long ago Cupid was at times represented with a helmet, a spear and a buckler, and riding on the back of a lion or on a dolphin, to show his power. The Greek *Eros* is identified with Cupid as the god of love. See PSYCHE.

CUPOLA, *ku'po la,* a word derived from the Latin *cupula,* meaning a *little bowl,* or *cup.* It is applied in architecture to a roof resembling an inverted bowl. The words *cupola* and *dome* are used synonymously, but they should be distinguished, for while a cupola is usually more or less inconspicuous, the term *dome* is applied to a large building, the roof of which could not be said to resemble a little cup. The term would not be applicable to the dome of the Capitol at Washington, for instance. Saint Paul's Cathedral, London, has one conspicuous dome and two cupolas, or smaller domes, covering portions of the building. The term *cupola* is also applied to a saucerlike turret beneath which guns are concealed in a fort.

CURACAO, or **CURACOA,** *koo rah so',* or *koo rah sah'o,* one of the Dutch West Indies, in the Caribbean Sea, about forty miles north of Venezuela. Although small, covering an area of only 210 square miles, the island is commercially important and is the center of a thriving Dutch colony. The surface of Curacao is for the most part flat and of coral formation, though in the south there are volcanic hills rising to a height of 1,200 feet. Owing to lack of rain, agriculture is backward, but sugar, corn, fruits and tobacco are raised. The island is noted for a bitter orange from which a popular liquor is made (see below). The principal mining products are salt and phosphate of lime. The colony is administered by a governor, appointed by the Crown of the Netherlands, with headquarters at Willemstad, the capital. Population of the island in 1913, 32,959; of the colony, 55,183.

Curacao, a popular cordial or liquor prepared from the yellow rind of a bitter orange grown on the island of Curacao. It has an aromatic odor and a somewhat cloying, fruity taste. The rind is first steeped in alcohol, then distilled and mixed with syrup. The genuine curacao is much imitated, substitutes being prepared from ordinary oranges and colored by chemical processes.

CURASSOW, *ku'ra so,* or *ku ras'o,* a large handsome bird resembling the domestic fowl, a native of tropical America. The crested curassow of Guiana, Mexico and Brazil is best known. It is nearly as large as a turkey, but more striking in appearance. The plumage is black, with a purplish-green gloss above and

[illegible] BEETLE, [illegible] widely [illegible] apricot, [illegible] fruit [illegible] They [illegible] buds. When fruit [illegible] beetle digs a [illegible] with her long [illegible] an egg, presses it [illegible] and then cuts a crescent-[illegible] around the egg. There the egg [illegible] fat, whitish grub which feeds on [illegible] ally around the stone. In most fruit falls from the tree when [illegible] dy to develop into the pupa [illegible] passed in the ground.

CURCULIO
About three times actual size.

[illegible] is infested with curculio grubs [illegible] rom the tree together with ma- [illegible] d caught in a paper or cloth

In that way a spread of the [illegible] rented. Spraying with arsenate [illegible], two pounds to fifty gallons of the beetles.

ur'fu, the ringing of a bell expressed it in his *Elegy*, "tolls [illegible] ting day." The ringing of the [illegible] om which originated as a pro- fire, but in modern usage tends [illegible] n of crime and the protection [illegible] he ringing of curfew in a few [illegible] is at eight or nine o'clock. [illegible] ccess of a curfew ordinance in- [illegible] aha, Neb., about 1880, similar [illegible] adopted at various times by [illegible] and towns of the United States, [illegible] in force, however, for but a [illegible] After the ringing of curfew, [illegible] ifteen years of age must not be [illegible] without the written consent of [illegible] arents or guardians, or unless accompanied by [illegible] ar adult. An improvement in the morals of [illegible] children has resulted. Colonel Alexander [illegible] Hogeland, who introduced the Omaha ordi- [illegible] nance, has been called the father of the curfew [illegible] law.

In England, the custom was introduced by William the Conqueror during the Middle Ages. At the ringing of the curfew the literal meaning of the French word, *to cover fire*, was observed, for all lights were extinguished and outdoor occupations ceased. In 1103 the law was repealed by Henry I, but the bell continued to be rung in many places and is still heard in small towns. That the custom was observed in England in the time of Cromwell is known from Rose Hartwick Thorpe's much-quoted poem, *Curfew Must Not Ring To-night*. It tells the thrilling story of a girl who saved her lover from death by swinging on the tongue of the church bell to prevent its sounding his doom. And when—

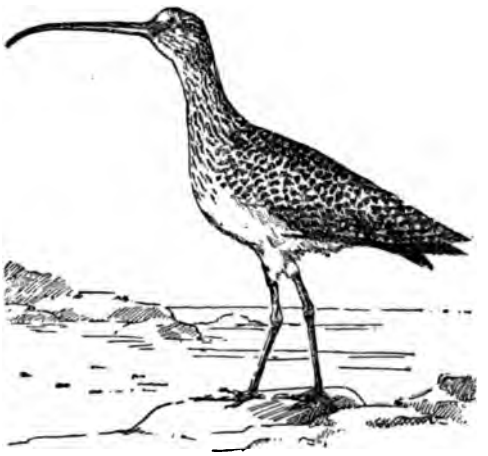
"It was o'er; the bell ceased swaying, and the maiden stepped once more
Firmly on the dark old ladder where for hundred years before
Human foot had not been planted. The brave deed that she had done
Should be told long ages after: as the rays of setting sun
Crimson all the sky with beauty, aged sires with heads of white,
Tell the eager, listening children,
"Curfew did not ring that night."

CURIE, *ku're'*, PIERRE (1859-1906), and MARIE SKLODOWSKA (1867-), French scientists who by combined research discovered the wonderful medicinal properties of radium (which see). Professor Curie was born in Paris and was educated at the Sorbonne, where he later became professor of physics. His wife, whose fame is even greater, is of Polish descent, and was also educated in Paris. Their joint discovery of radium, announced in 1898, brought them immediate recognition from the scientific world. In 1903 they were awarded the Davy Medal of the Royal Society and one-half of the Nobel prize for that year for physics. Professor Curie died in 1906 but his

MADAME CURIE

wife continued her researches. She succeeded her husband as professor of physics at the Sorbonne and in 1911 received the Nobel prize in chemistry.

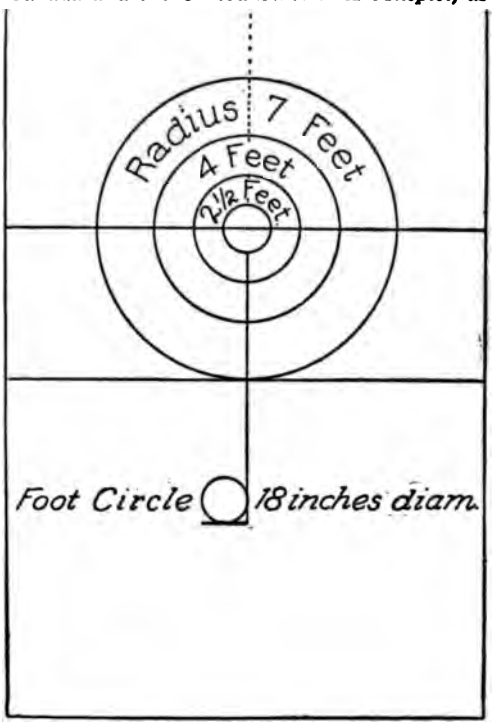
CURLEW, *kur'lu,* a genus of long-legged birds with long, slender, downward-curved bills, found throughout almost all the world. In the Americas several species are seen the year round, from Patagonia to Arctic regions. The



THE CURLEW

most common, known as the *long-billed curlew,* is about twenty-four inches long, including its slender, eight-inch bill, with which it drags small crabs and shellfish from wet sands, and snails and worms from the ground. On the prairies it snatches grasshoppers, beetles and berries. Its plumage is pale brown or buff above, mottled with black and dark brown, and nearly white below. The limbs are slender and partly naked; the tail is short and rounded. Curlews of the interior are valued for their flesh and eggs. Wedge-shaped, gooselike flocks of these birds migrating across Canada are a common sight, and their long whistling note is a familiar sound.

CURLING, *kurl'ing,* a game played on the ice, one of the few amusements concerning the origin of which there is no doubt. It has been popular in Scotland for more than three centuries and has been adopted in Canada and the United States; in Canada, especially, it has become a national winter sport. The game has increased so much in favor that international matches are annually played between Canada and the United States. A *bonspiel,* as

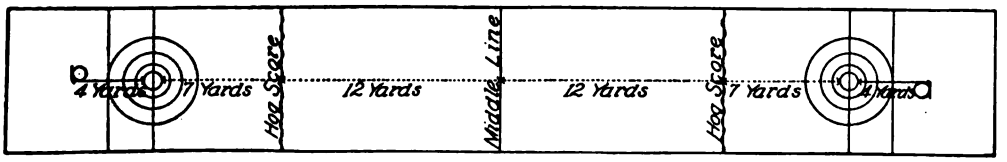


ENLARGED END OF FIELD

POSITION FOR DELIVERY

a curling tournament is called, is the chief winter attraction in many Canadian cities.

The game is played on a rink marked out on



FIELD MEASUREMENTS

the ice, with large, smooth stones to which handles are fixed. It might be called bowls on ice, as the rules and methods of curling are quite similar to those governing the game of bowls. The stones weigh from thirty to forty-five pounds. There are usually four players on a side, or team. Each player uses two stones, which he slides along the ice towards a mark forty-two yards distant. The object is for a player to lay his stones closer to the mark than those of his opponents. After all players have "curled," or played, the side having stones nearest the mark scores a point for each stone so placed. In Canada and the United States iron curlers are sometimes used instead of stones. W.C.

See Spalding's *Guide to Curling*, for complete rules governing players.

CURRANT, *kur'ant*, a small, smooth, tart berry, cultivated in gardens in all temperate regions except in Africa. The bush on which it grows has slender branches bearing small, broad leaves, which shield first the greenish

THE CURRANT
Branch, fruit and cross section of fruit.

flowers from the sun, then the grapelike bunches of pea-sized globes of red, black or white fruit. Red currants, although used as dessert fruit, are most popular for jams, jellies and pies. White currants, similarly used, are a cultivated variety of the red. In the United States the currant crops of commerce are produced chiefly in the Middle Atlantic and East North Central states, the average annual crop being about 11,000,000 quarts, valued at nearly $800,000, New York state producing about one-third of the crop. The province of Ontario produces a good crop.

Black currants have a stronger taste and odor than the red and the white, and are valued for wine making and for their supposed [illegible]icinal qualities in throat troubles and as [illegible]ic. They are little grown in the United [illegible], but are very abundant in Canada and [illegible]pe.

[illegible] number of species of currant are valued for ornament. Most currant bushes are grown from cuttings six to ten inches long. Strong, moist loam in a cool location is the most favorable, and although currants are hardy and thrive even if neglected, frequent cultivation, enriching of the soil and pruning will be rewarded by larger berries and greater quantities. Various diseases to which currant bushes are subject can be prevented by use of a fungicide; the currant worm, one of the most serious pests of the shrub, can be effectively removed by sprinkling with a solution of one teaspoonful of powdered hellebore to a gallon of water.

The name *currant* was derived from ancient Corinth, in Greece, the city from which great quantities of a seedless raisin called currant were originally sent. See RAISINS.

CURRENCY. This subject is treated in the article MONEY.

CURRENT, ELECTRIC, the flow of electric energy from one body to another. The amount of electric energy that a charged body contains is its *electric potential*. When two bodies are unevenly charged, one has a higher potential than the other. If these bodies are connected by a conductor the electric energy will flow from the higher to the lower potential and this flow will continue until the potentials of the bodies are equalized. The force which causes the flow is called the *electromotive force* (which see), and it is likened to the pressure which causes the flow of water through a pipe. In order that the current may continue it is necessary that the supply of electric energy also be continuous. The simplest device for producing an electric current is the voltaic cell (see ELECTRIC BATTERY). In this cell the chemical action at one plate is greater than that at the other; hence the potential of one plate is higher than that of the other. If these plates are connected by a copper wire so as to complete the circuit, a current will flow from one to the other and the current will continue until the chemical power in the cell is exhausted. If the wires are separated the circuit is broken and the current stops, unless it is strong enough to leap over the gap. When this occurs a spark is formed.

Air, rubber, glass, mica, dry wood and other substances will stop the current, and are known as *non-conductors* or *insulators*. Both conductors and insulators are necessary to the flow of a current between the desired points, as between the battery and the telegraph instrument, for if the line wires were not supported

on insulators most of the current would flow to the ground along the poles and be lost. Sometimes wires carrying the current for operating electric motors, as on street car lines, are incased in rubber to prevent loss by the air, which at all times takes some energy from the conductor.

According to the method of generating them electric currents are of two classes, direct and alternating.

Direct Current. A direct current is one that flows continuously in the same direction, like that produced by an electric battery. The direct current is used for ringing electric bells, in experiments in the laboratory and in operating electric motors where great power is required in starting and frequent variation of speed is necessary, as on electric cars.

Alternating Current. An alternating current is one whose direction is rapidly reversed by the use of a magnet. If a magnet is placed in a coil of wire along which an electric current is flowing, the current is reversed. When the magnet is withdrawn, the current again flows in its original direction. The same effect is produced whether a permanent or an electric magnet is used. Many devices have been invented for the purpose of reversing the current, but the one in most common use is the revolving electromagnet which causes the reversal by reversing its poles. The alternating current is used for electric lighting and for electric motors where a uniform rate of speed is required. See ELECTRICITY; ELECTROMAGNET; ELECTROMAGNETISM; ELECTRIC MOTOR.

CURRENTS, OCEAN. See OCEAN CURRENTS.

CURTIS, GEORGE WILLIAM (1824-1892), an American essayist, editor and lecturer who was one of the best-loved and most highly-respected public men of his time. He was born in Providence, R. I. At the age of eighteen he found himself interested in the Transcendental movement (see TRANSCENDENTALISM), and for two years lived at Brook Farm (which see). After spending a few years in European and Eastern travel, Curtis returned home in 1850 and began a brilliant career in New York City. He became associate editor of *Putnam's Magazine*, and for this periodical and for *Harper's Monthly* wrote a large number of essays that at once struck the popular fancy. The most important collections of his essays are the *Potiphar Papers*, gently satirizing the fashionable society of his time, and *Prue and I*, a study of life in which humor, tenderness and sentiment are pleasingly blended. "The Editor's Easy Chair," which he created for *Harper's Monthly*, was for years one of the most popular departments of that periodical.

Curtis became political editor of *Harper's Weekly* in 1863, and made that journal a powerful force in shaping public opinion during the War of Secession and after its close. He was one of the founders of the Republican party and one of its most influential leaders until 1884, when he became an independent in politics. In the advancement of civil service reform he was long a conspicuous figure, and the report which he wrote as chairman of the civil service commission, in 1871, has been the basis of later efforts to extend and purify the service.

CURTISS, GLENN HAMMOND (1878-), the inventor of the flying boat, an American whose

CURTISS'S "FLYING TROPHY"
Neptune and Mercury hailing the airship sailing above the clouds.

name stands next to that of the Wright brothers in the list of famous contributors to the science of air navigation (see FLYING MACHINE). He holds many patents for biplane

devices and has received a medal from the Smithsonian Institution and others from the Aero Club of America.

A boyhood interest in bicycle racing led to Curtiss's flying career. After winning a number of contests with the old-style pedal bicycle he invented a motor-cycle, on which in 1906 he traveled a mile in 26⅘ seconds, a speed of over 136 miles per hour, the fastest up to that time traveled by man. Success in building light but powerful motors induced him to try aeroplaning. In 1906 he won the *Scientific American* trophy for a flight of over a mile; in 1909, the Gordon Bennett cup for a flight at Rheims, France, at a speed of nearly forty-seven miles an hour, and in 1910 a $10,000 prize for a flight from New York to Albany, 142 miles, with only three stops. He then turned his attention to the manufacture of aeroplanes and the development of flying boats. In 1914 he made a flight in the famous Langley machine, built in 1903 before the first Wright fliers, but never before successfully operated. See WRIGHT, ORVILLE and WILBUR; LANGLEY, S. P.

CURVE, *kurv,* a line no portion of which is straight. A continuous uniformly-curved line is called a circle (which see). Aside from its important place in higher mathematics, too technical for discussion here, the term *curve* has various applications and meanings. Such expressions as "the railway curve" or "the curve of the winding road" are familiar; this idea is poetically expressed by Tennyson in the often-quoted lines from *The Song of the Brook:*

> With many a *curve* my banks I fret
> By many a field and fallow.

Curved lines are widely used in text-books and official reports to represent variations in temperature, population, rainfall, etc. In baseball, the term is used in connection with a ball so thrown that its course is a curve which varies from that ordinarily taken, the variation being due to a peculiar rotation of the ball and the resisting power of the air.

CURZON, *kur'zon,* GEORGE NATHANIEL, Lord (1859-), an English statesman who, as Viceroy of India, materially assisted in consolidating the Indian Empire and gained a reputation for diplomacy of a high order. He was educated at Eton and Oxford and later became private secretary to Lord Salisbury. He was elected to Parliament as member for Southport, Lancashire, and held his seat for twelve years. In 1895 he married Mary Victoria Leiter, daughter of a wealthy Chicago merchant. In 1899 he was appointed Viceroy of India, a position he retained until 1905. He endeavored to conciliate the natives of India, but showed firmness in his dealings with them. He took a keen interest in educational movements, and was instrumental in greatly increasing the numbers of available teachers and of schools. He viewed with distrust the growth of Russian influence in the East and urged strong military preparations to check Russia's designs. A disagreement with Lord Kitchener on military matters led to his resignation, and on returning to England he was made a peer and took his place in the House of Lords. His works, *Persia and the Persian Question, Russia in Central Asia* and *Problems of the Far East,* are regarded as authoritative.

In 1916, ten years after the death of his first wife, Lord Curzon was married to Mrs. Grace Duggan of Buenos Aires.

CUSHMAN, CHARLOTTE SAUNDERS (1816-1876), one of the greatest tragic actresses of America, the first member of the theatrical profession whose name has been placed in the Hall of Fame (which see). This honor was accorded her in 1915. She was born in Boston. Possessing a fine contralto voice, she began when a young girl to study for the operatic stage, but after straining her voice in singing high rôles she devoted herself to drama. In 1835 she appeared as *Lady Macbeth,* always one of her greatest rôles. She also won praise for her interpretation of the part of Meg Merrilies, in Scott's *Guy Mannering.* Although she occasionally played in high comedy, Miss Cushman was best known as a tragedienne. She had immediate success in both London and Dublin, and remained abroad for several years. The latter part of her life she spent in America, and on her last appearance on the stage, in New York City, November, 1874, she was presented with a laurel crown, William Cullen Bryant acting as spokesman.

CUS'TER, GEORGE ARMSTRONG (1839-1876), an American soldier whose story is one of wild life on the plains and of bloody Indian warfare in the service of his country. He was born at New Rumley, Ohio. After graduating from West Point, at the outbreak of the War of Secession he was given a commission in a cavalry regiment. Carrying dispatches from Washington to General McDowell, he arrived at the front just in time to take part in the first Battle of Bull Run. He was appointed aid-de-camp to General McClellan, who was

impressed by Custer's energy and bravery. The first colors captured by the Union army were taken by Captain Custer. By 1863 he had gained the rank of major and later became major-general of volunteers.

From 1866 to the time of his death he was known as *Yellow Hair*, a fighter of Indians on the plains of Montana and Dakota. His last battle was fought in June, 1876, when he with his whole command was defeated and massacred on the Little Big Horn, by the Sioux under Sitting Bull. The spot has been made a national cemetery, and places in Montana and in the Black Hills of South Dakota, as well as in a number of other states, are named for him. In Longfellow's poem, *The Revenge of Rain-in-the-Face*, the story of Custer's last battle is told. He was buried at West Point, where a statue was erected in his honor.

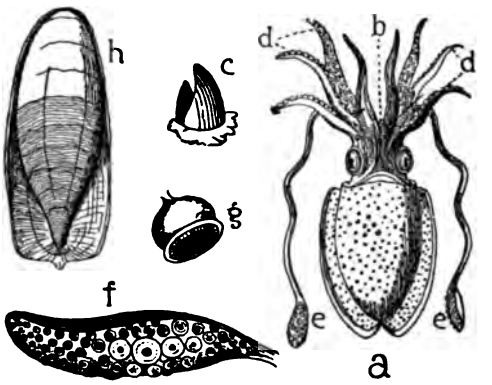
CUS'TIS, GEORGE WASHINGTON PARKE (1781-1857), the adopted son of George Washington and grandson of Martha Washington, and an author of several plays. It was he who erected the Arlington mansion on the site of the present Arlington National Cemetery, once the home of Robert E. Lee through the latter's marriage with the daughter of Custis. Custis is best known for his publication of *Recollections of Washington*.

CUSTOMS DUTIES. If you enter the city of Rome from any other part of Italy inspectors will examine your baggage and perhaps exact a tax upon certain goods which you are bringing in. There was a time when nearly all cities observed the custom of so taxing their commerce, and that is probably why taxes on imports and exports came to be known as *customs* duties. Nowadays they are generally levied only on international trade; in the United States, in fact, the Constitution expressly provides that "no state shall . . . lay any imposts or duties on imports or exports." The same Constitution rules that "no tax or duty shall be laid on articles exported," but there are a few nations which do have export duties. Brazil and Haiti, for instance, collect money on all coffee sent abroad.

Not all countries have the same reason for maintaining customs duties. England, called a *free trade* country, taxes only such imports as liquors, tobacco, tea and sugar, and does it solely to gain revenue. Canada, on the other hand, provides duties on all sorts of manufactured goods and farm products, so that Canadian producers will have an advantage over foreign merchants. See TARIFF.

If customs charges are based on the *quantity* of imports, the duties are said to be *specific;* if according to the *value* of imports, they are described by the Latin phrase *ad valorem*, meaning *according to value*. Specific duties are apt to favor producers of cheap goods. Thus, if foreign baking powder is taxed six cents a pound, the grade worth twenty-five cents bears a charge of nearly one-fourth its price, while that worth fifty cents has a duty of less than one-eighth, and home manufacturers of the cheaper grade will meet less foreign competition. *Ad valorem* duties, if correctly calculated, avoid this injustice, but because of the tendency of importers to understate values they are difficult to apply. Sometimes imports are charged with a combination of *ad valorem* and specific rates.

CUTTLEFISH, *kut''l fish*, a shellfish whose internal shell is the broad, spongy, chalky *cuttlebone*, used by cage birds to sharpen their beaks, also in powdered form by people, to clean their teeth. The cuttlefish is important,



CUTTLEFISH

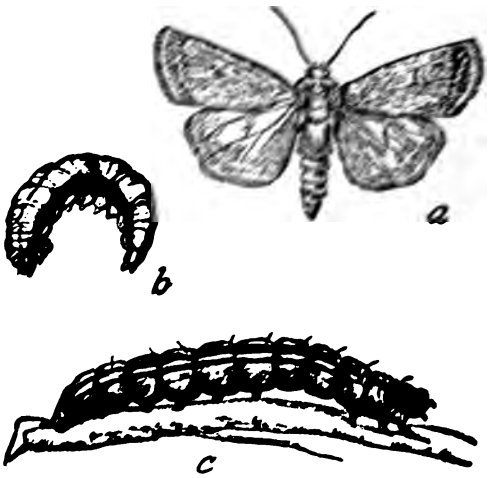
(*a*) General view; (*b*) location of mouth; (*c*) mouth; (*d*) arms, with suckers; (*e*) tentacle with suckers on end; (*f*) end of tentacle, showing suckers; (*g*) one of the suckers; (*h*) interior shell, called *cuttlebone*.

too, for the production of the pigment sepia (which see), an inky substance which it expels when alarmed, so darkening the water and making possible its escape.

Cuttlefish are found in all seas, usually in deep water but occasionally near shore. They are commonly about nine inches long, but some are as long as seven feet. Their bodies are brown, cross-banded and spotted with purple, showing brilliantly metallic in sunlight, or changing color at will. Eight short arms and two long tentacles, all bearing four rows of horny-rimmed suckers, surround the mouth. The tentacles can be drawn into pockets behind

the eyes. The arms are used to catch shellfish food, or to attach the animal to various objects. In the broad head are two large eyes. A frilled fin edges the oval body. By drawing in or forcing out jets of water from a funnel, cuttlefish are enabled to move backward or forward.

CUT'WORM, a greasy, dull-brown or gray caterpillar pest of gardens, fields and orchards, the larva (young) of a yellowish or pearl-gray night moth. This destructive worm hides in the ground by day and at night comes forth to



CUTWORM

(a, b) Moth and larva of one common species; *(c)* larva of another species. About actual size.

feed. It cuts off young plants at the level of the ground, destroying more than it eats. Little armies of cutworms have been known to destroy entire fields of young wheat, Indian corn or garden vegetables over night. They also attack tobacco, cotton and leaves and buds of fruit trees. Treatment with poison sprays is effective in destroying these pests. An excellent preventive consists in sprinkling the ground with poisoned branmash before the plants come above the ground, for cutworms will eat a mixture of Paris green, bran, and sugar-sweetened water in preference to vegetation.

CUVIER, *ku vya'*, GEORGES LÉOPOLD CHRÉTIEN FRÉDÉRIC DAGOBERT, Baron (1769-1832), one of the greatest naturalists the world has produced, was born at Montbeliard, France. After finishing his education at Stuttgart he accepted [illegible]on as tutor in Normandy. Several [illegible]ological topics established his rep- [illegible] procured him admission to the [illegible]ties of Paris. In 1802 he succeeded to the chair of comparative anatomy at the Jardin des Plantes (botanical and zoological garden), and devoted himself to the studies which have perpetuated his name. His great book on the animal kingdom (*Le Règne Animal*) was for a long time the highest authority on zoology; this and many other works raised him to the pinnacle of scientific fame. Cuvier filled many offices of importance, particularly those connected with educational institutions. Napoleon treated him with much consideration, and Louis Philippe raised him to the rank of a peer of the realm. He died suddenly of paralysis in Paris.

CUZCO, *koos'ko*, a city far inland in South Central Peru, the capital of a department, or state, of the same name, situated in the center of a fertile agricultural district in the Andes. It is 11,200 feet above sea level, and although only 12° south of the equator, has a mild and inviting climate. Important manufactures of woolen and cotton goods, sugar, embroidery and leather are carried on and there is extensive island commerce. Cuzco is one of South America's oldest cities, founded in the eleventh century, and at one time was the capital of the empire of the Incas (see INCA). The ancient city was stormed and destroyed by Pizarro in 1535, but remains of its former glory are seen in the palace of the Incas and a mighty Temple of the Sun, the object of their worship. The modern city is well built and contains many handsome buildings. Population, about 30,000.

CYANOGEN, *si an'o jen*, a colorless gas formed by the union of carbon and nitrogen. It has the odor of peach pits and burns with a purplish flame. It is valuable only for its compounds. A compound of cyanogen with a metallic element is called a *cyanide*. When a cyanide is heated with sulphuric acid the deadly poison *prussic acid* is formed. *Potassium cyanide*, the most important compound, is used in large quantities in the "cyanide process" of extracting gold from its ores. See GOLD.

CYCADS, *si'kadz*, a family of large tropical and sub-tropical naked-seeded plants (gymnosperms) of palm- or fern-like appearance and habits. As they bear cones, however, they are more nearly related to pines than to the palms. Fossil remains show that such plants, with their columnlike stems topped with rosettes of feathery, fernlike leaves and huge cones, were once very abundant everywhere, but they are found only in small areas at present. One species, however, is still almost as thick as

weeds in Southern Florida. The stems of some cycads are like large tubers, almost or entirely underground. Cycad stems store immense quantities of starch, for which they are collected in some countries for the production of *sago* (which see). That has caused the tree to be incorrectly called *sago palm,* but the sago of commerce is obtained from a true palm.

CYCLADES, *sik'la deez,* a group of islands in the Aegean Sea, southeast of Greece, to which country they belong. The principal islands are Andros, Paros, Naxos, Rhenea, Syra and Delos, some of them famous in ancient myths and story. The name is derived from the Greek *kyklos,* meaning a *circle,* and was given to the islands because they are supposed to form a protecting circle around the sacred island of Delos. The soil is naturally fertile, but lack of water is a serious handicap to agriculture. Fishing is the principal occupation of the inhabitants, though olives and grapes are grown in considerable quantities. The chief source of revenue lies in valuable deposits of building stone, which is extensively quarried. The commercial center is Hermopolis, a town with a good harbor, on the island of Syra. Population of the group, 130,378.

CYCLAMEN, *sik'la men,* a genus of handsome, winter-blooming, tuberous-rooted plants of the primrose family, natives of Europe and

CYCLAMEN

Asia, but cultivated in homes and greenhouses in America. The flowers are scentless, with white, rose-colored or purple petals turned backward as if the flowers had been turned inside out. The latter are from two to two and a half inches long and droop downward on their stems. The leaves are large, heart-shaped, glossy and of varying tints. Although usually purchased in pots already flowering, with a little care the cyclamen can be raised from seed in a light, rich soil. While the seeds are germinating a temperature of 50° to 60° F. and plenty of water are required.

In Southern Europe the turniplike, bitter, partly underground stems of the cyclamen are relished by swine.

CYCLONE, *si'klohn,* in physical geography, is the name applied to a form of atmospheric disturbance in which there is a central area

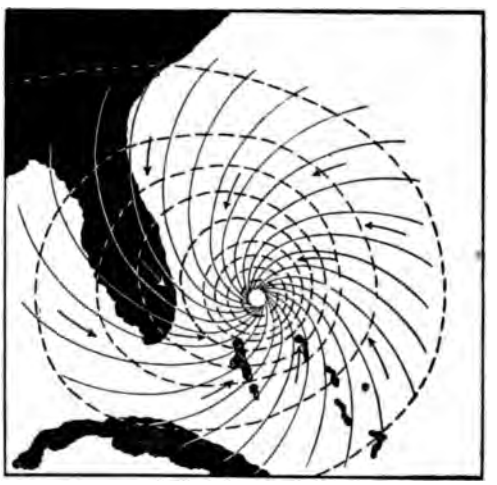


DIAGRAM OF FIELD OF ACTION

The solid, converging lines indicate motion of the wind; the dotted lines, the general path of the storm.

of atmospheric pressure lower than that of surrounding areas, with the wind blowing spirally around and in toward this center. According to popular usage a *cyclone* is a violent revolving windstorm that occurs with more or less frequency in the Mississippi Valley and causes great destruction of life and property, but such storms are properly called *tornadoes.* The destructive storms that periodically sweep over the West Indies, known as *hurricanes,* are sometimes called the *cyclones of the tropics.* Tornadoes and hurricanes, together with the *whirlwind,* which varies in magnitude from an eddy of dust in the street to a storm as violent as a tornado, are all classed as *cyclonic storms.* The term *cyclone* therefore is general, and a cyclonic disturbance may be a mild rainstorm or a devastating gale.

Cyclones are caused by local differences in

temperature, and they originate in areas that have low atmospheric pressure. In the vertical system of atmospheric circulation the surface air, which is warmed by the heat radiated from the earth, is constantly ascending, while the colder air above is constantly descending. When in any locality there is a period of calm this vertical circulation of the air is arrested, and the result is a condition of unstable equilibrium. In other words, a heavy stationary layer of cold air overlies a surface layer of warm light air. When finally the air is set in motion by a current from without, the cold air rushes downward and there is an inflow from all the surrounding areas. This inflow moves in a spiral direction, with a gradual increase of intensity, and when it reaches the upper regions of the air the moisture is condensed, clouds form and rain often falls. The cyclonic disturbance has two movements—the *rotating whirl* toward the center of low pressure and the *forward movement* of the entire storm.

Nearly all land storms are of a cyclonic nature, but many of them are so mild that their rotary motion is not noticed by any except trained observers of the Weather Bureau. These storms travel in the direction of the prevailing winds; the spiral whirl of cyclones in the northern hemisphere moves in the opposite direction from that of the hands of the clock, and in the southern hemisphere in the reverse direction. North of the equator the movement is first toward the northwest and then toward the northeast. In the southern hemisphere it is southwest, then southeast. The corresponding movements towards centers of high pressure, in which the currents of air flow spirally from the central area outward, are called *anticyclones*. The central area of an anticyclone is an area of clear skies and fair weather.

Related Subjects. The following articles in these volumes will make more clear the general principle of a cyclonic disturbance and the distinction between various types:

Barometer	Tornado
Hurricane	Typhoon
Storms	Whirlwind

See, also, WIND, and the topics listed there.

CYCLOPES, *si klo'peez,* in Grecian legend, a race of giant shepherds. Each had only one eye, which was placed in the middle of the forehead. These giants dwelt in Sicily. In the story of Hesiod they were the sons of Uranus and Gaea, or Heaven and Earth, and were slain by Apollo for having furnished Zeus with thunderbolts to kill Asclepius. See MYTHOLOGY.

CYLINDER, *sil'in der.* A circular solid having the same diameter throughout its length, and having as its ends two equal parallel circles, is called a *cylinder.* These circles are called the *bases* of the cylinder; the distance between the bases is the *altitude* (*a-a*) of the cylinder; the curving surface is called its *lateral,* or *convex,* surface (Fig. 1).

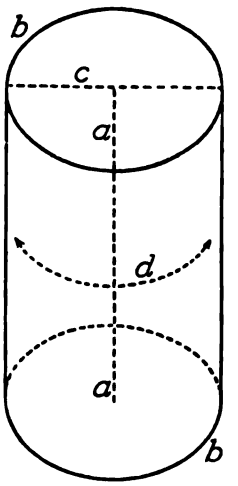


FIG. 1
(*a-a*) Altitude; (*b*) perimeter of base; (*c*) diameter of base; (*d*) lateral surface of cylinder.

We see this figure in water pipes, gas pipes, logs, iron rods, tin vegetable cans, water tanks and so forth.

From a rectangular piece of tin or paper six inches long and four inches wide you can make a cylinder six inches in circumference and four inches high, allowing no material for a lap (Fig. 2). From this it is seen that the lateral surface of a cylinder is equal in area to a rectangle whose length is equal to the circumference of the cylinder and whose width is equal to the altitude of the cylinder.

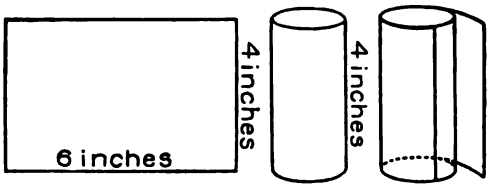


FIG. 2
Showing the relation between the area of the lateral surface and that of a rectangle of similar dimensions.

Therefore we have this law: *Area of lateral surface of a cylinder is the product of the circumference and the altitude* when these two dimensions are expressed in the same linear units. For example: Find the lateral surface of a water pipe whose circumference is 30 inches, and whose length is 20 feet. Solution: lateral surface in square feet=20×2½=50, or lateral surface in square inches=240×30=7200.

If we know the diameter or radius, and the altitude of a cylinder, to find its lateral surface, we first find the circumference and proceed as before. Circumference equals 3.1416 ×diameter or 2×3.1416×radius (see CIRCLE). For example: Find how many square inches of tin in the lateral surface of a can 3 inches in

radius and 10 inches high. The solution follows:

Circumference of a circle $=2\times3.1416\times$ radius.
Circumference of can in sq. in. $=2\times3.1416\times3=18.8496$.
Lateral surface in sq. in. $=10\times18.8496=188.496$.

How many square inches of tin will be required for the entire can? The bases are circles; therefore the area of each base equals $3.1416\times\text{radius}^2$ (see CIRCLE).

Area of 2 bases in sq. in. $=(3.1416\times3^2)\times2=56.5488$.
Lateral surface in sq. in. $=188.496$.
Entire surface in sq. in. $=245.0448$ (sum of 56.5488 and 188.496).

The volume of a cylinder equals the product of the area of one base and the altitude; expressed more concisely:

Volume of cylinder $=3.1416\times\text{radius}^2\times$ altitude.

The number of cubic inches in the above can is found as follows:

Radius $=3$ in.
Altitude $=10$ in.
Volume in cu. in. $=3.1416\times3^2\times10=282.744$.

Practical Problems. A well is 30 feet deep and 4 feet in diameter. How many gallons of water will it hold?

We see that the well is a cylinder. The base is a circle whose radius is 2 feet, and the depth of well, 30 feet, is the altitude of the cylinder. The solution is as follows:

Area of base in sq. ft. $=3.1416\times2^2=12.5664$.
Volume in cu. ft. $=12.5664\times30=376.992$.
1 cu. ft. $=1728$ cu. in.
376.992 cu. ft. $=376.992\times1728$ cu. in. $=651442.176$ cu. in.
231 cu. in. $=1$ gallon.
Number gal. in well $=651442.176\div231=2820.096$.

The solution may be shortened as below by cancellation:

Radius $=2$ ft.
Area of base in sq. ft. $=3.1416\times2^2=12.5664$.
Volume in cu. ft. $=12.5664\times30=376.992$.
231 cu. in. $=1$ gallon.
1728 cu. in. $=1$ ft.

$$\text{Number gallons in well}=\frac{\cancel{376.992}^{4.896}\times\cancel{1728}^{576}}{\cancel{231}_{77}}=2820.096$$

How many square inches are there in the lateral surface of a lead pencil which is one-fourth inch in diameter and six inches long?

Take a piece of paper 11½ inches wide and 20 inches long. Roll it to form a cylinder, using the ½ inch from 11½ inches to paste as a lap. What is the circumference of the cylinder? Find its diameter and radius.

The circumference $=3.1416\times$ diameter. Therefore $11=3.1416\times$ diameter. (For many practical problems we may use $3\frac{1}{7}$ instead of 3.1416.) Do so here and see that $11=3\frac{1}{7}\times$ diameter; diameter $=11\div3\frac{1}{7}=\frac{11}{3\frac{1}{7}}=\frac{\cancel{11}^{1}}{1}\times\frac{7}{\cancel{22}_{2}}=3\frac{1}{2}$; radius $=\frac{1}{2}$ of $3\frac{1}{2}=1\frac{3}{4}$.

Find the area of the ends of your cylinder. Solution as follows:

Area of a circle $=3\frac{1}{7}\times\text{radius}^2$.
Area of 2 bases $=3\frac{1}{7}\times(1\frac{3}{4})^2\times2=$

$$\frac{\cancel{22}^{11}}{\cancel{7}_{1}}\times\frac{\cancel{49}^{7}}{\cancel{16}_{8}}\times\frac{\cancel{2}^{1}}{\cancel{2}_{1}}=\frac{77}{4}=19\frac{1}{4}.$$

Area of bases $=19\frac{1}{4}$ sq. in.

Second solution: We may use the fact that

$$\text{Area}=\frac{\text{radius}}{2}\times\text{circumference}.$$

Area of 1 base $=\frac{1\frac{3}{4}}{2}\times11=\frac{7}{4}\times\frac{1}{2}\times11=9\frac{5}{8}$
Area of 2 bases $=2\times9\frac{5}{8}=19\frac{1}{4}$.
Area of bases $=19\frac{1}{4}$ sq. in.

How many cubic feet of water can be stored in a cylindrical reservoir 40 feet in radius and 60 feet high?

The volume of the cylinder is a problem which enters largely into the industrial world; for example, in the building of reservoirs, pipes and tanks for transporting oils, and in the construction of engines and machines of various kinds, a knowledge of the capacity of the cylinder is essential. A.H.

CYNIC, *sin'ik*, SCHOOL OF PHILOSOPHY, a system of Greek philosophy founded in the fourth century B. C. by Antisthenes, a disciple of Socrates. He took as his starting point the doctrine of his great teacher, that virtue and not pleasure is the chief end of life, and it alone constitutes true happiness. From this he argued that since continued happiness is not possible if man has wants and desires which may not be satisfied, virtue consists in living as much as possible unfettered by desires. Therefore, the wise man is the one who looks with indifference on all the ordinary pleasures of life and who lives for and in himself alone.

Among the enthusiastic followers of Antisthenes was Diogenes (which see), who carried the principles of the school to an extreme, living, it is said, on the coarsest bread and sleeping at night in a tub. Zeno and Demetrius, the latter of the later Roman period, were other distinguished Cynics. Though not of the greatest importance as a school of philosophers, the Cynics form the link between Soc-

rates and the more influential Stoics (see STOICISM).

Authorities differ as to the derivation of the name *Cynic,* some referring it to Cynosarges, the name of the building in Athens in which the Cynics first met, and some to the Greek word for *dog,* alluding to the rude manners of the members of the school. In modern usage the word *cynic* implies a sneering tendency to deny that goodness exists in human nature.

CYPRESS, *si'pres,* a genus of somber, slow-growing, cone-bearing trees, most of which are evergreen and valued both for ornament and for lumber. They are natives of Western North America, Europe and Asia, growing chiefly

CYPRESS
Branch, leaves and cones.

in moist, warm climates, although also cultivated to some extent in dry places. The leaves are small, dark, sharp-pointed, placed in a comblike arrangement on the twigs. The flowers are tiny and yellowish. The cones are ball-like, with a few woody scales.

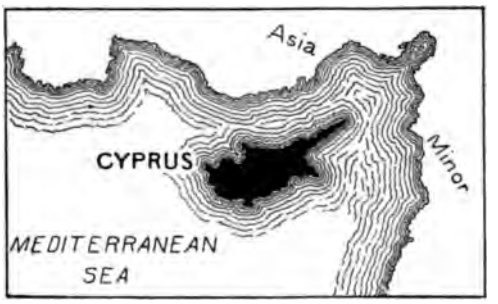
The best-known cypress is the *common cypress* of Southern Europe, which has been introduced into America and England. It is a dark, thickly-leafed, somewhat quadrangular tree which takes the form of a pyramid at the top. It reaches a great age, and its red or yellowish wood of pleasant odor is very durable, withstanding weather and insect pests. Its present use is chiefly for musical instruments and cabinet work. Such trees have long been used in cemeteries, and branches of cypress were formerly worn as emblems of mourning at funerals. The Monterey cypresses, gnarled, flat-topped, of grotesque shapes, are fine examples of this variety of trees.

The *bald cypress,* which sheds its leaves and is therefore deciduous, is one of the most valuable of timber trees (see DECIDUOUS TREES). It reaches a height of 150 feet in the swamps of the Southern United States. Where it grows to best advantage great forests cover many square miles. Its wood is soft, easily worked and durable, and is commonly used for shingles, ties, posts and interior finish. A peculiar feature of this tree is the development of knots, or *knees,* upon the roots at its spreading base. Such growths sometimes reach a height of ten feet. Small cypress knees are often hollowed and made into bowls and buckets.

The annual lumber cut of cypress in the United States amounts to nearly 1,000,000,000 board feet, valued at more than $20,000,000; Louisiana furnishes about two-thirds of the supply, and Florida is second, with ten per cent. Other states which cut over 25,000,000 feet annually are Georgia, Arkansas, North Carolina and South Carolina. M.S.

CYPRUS, *si'prus,* after Sicily and Sardinia the largest island in the Mediterranean Sea. It occupies 3,584 square miles in the northeast corner, forty miles from the coast of Asia Minor, and is nearly three times the size of Rhode Island. Mountain ranges border its north and south coasts, rising at one point to a height of nearly 6,500 feet, and between them lies a plain now bare and little cultivated but once covered with forests which supplied timber for the Greek, Persian and Egyptian fleets.

Agriculture is the occupation of most of the people. Typical Mediterranean products are raised, all in the most primitive fashion, but the government is educating the natives in modern methods, is building irrigation works and re-planting the forests. Strabo, Pliny and other ancient geographers tell of great min-



LOCATION MAP

eral wealth, and our word *copper* once meant *metal from Cyprus,* for which the Greek name was *Kupros.* To-day no metals are produced, but the island is one of the world's few sources of asbestos, gypsum and umber.

Like all lands of the Eastern Mediterranean, Cyprus has a story with many chapters. Egypt conquered its Greek and Phoenician colonists

3,500 years ago, then Assyria, and still later, Persia. It formed part of the empires of Alexander and the Ptolemies, of Rome, Byzantium and Bagdad. During the Crusades it fell to Richard the Lion-Hearted, and for three centuries was a feudal kingdom. After a brief Venetian rule the Turks governed for another 300 years. From 1878 England administered the island for Turkey, but annexed it in 1914. Of the 300,000 people four-fifths are Christians, of an independent Church founded by Barnabas, who is mentioned in the *Acts* as "of the country of Cyprus." Many of the people desire union with Greece, and England in 1915 offered the island to the latter country for assistance in the War of the Nations.

CYRUS, *si'rus,* called THE GREAT, or THE ELDER (about 600-529 B. C.), conqueror of Babylon and founder of the Persian Empire. According to recently-discovered cuneiform inscriptions now in the British Museum, he was

TOMB OF CYRUS

Cyrus had placed upon his tomb these words: "Oh, man! whosoever thou art, and whencesoever thou comest (for come I know thou wilt), I am Cyrus, the founder of the Persian Empire; envy me not the little earth that covers my body." Alexander the Great visited the tomb, and was much affected by the inscription, which placed before him the uncertainty and vicissitude of earthly things. The tomb was broken open, and Alexander caused the author of the sacrilege to be put to death. The location is 550 miles east of old Babylon.

the son of Cambyses and Mandane, a daughter of the Median king Astyages. Legends state that Astyages feared overthrow at the hands of his grandson, Cyrus, and endeavored to have him killed when an infant. Cyrus was protected by a shepherd and was eventually restored to his parents.

Whether previously prophesied or not, the fact remains that Cyrus began his remarkable career by collecting a vast army of Persians, with which he overthrew his grandfather and became king of Media and Persia. He next made himself master of Lydia by defeating Croesus. At that time Nabonidus, king of Babylon, was unpopular with his subjects, and Cyrus considered the time favorable for an attack upon that empire. The city fell almost without a struggle before the victorious hosts of Cyrus, who declared himself king. He proved a wise and generous ruler and permitted the Jews to return to Jerusalem from captivity. His ambition and desire to increase his already vast domains led to his downfall. While conducting an expedition against the Scythians, north of his kingdom, he was slain in a battle against the forces of the Scythian queen Tomyris. His body was buried at Pasargadae, where his tomb, silent and empty, still stands alongside a broken monolith that once bore witness to his greatness.

CYRUS (? -401 B. C.), THE YOUNGER, so called to distinguish him from Cyrus, founder of the Medo-Persian Empire. He was a son of Darius II and brother of Artaxerxes, who became king of Persia in 404 B. C. Bitterly jealous of his brother's power, Cyrus conspired against him. His plots were discovered and he was condemned to death, but was spared by Artaxerxes in answer to his mother's entreaty. While acting as *satrap,* or governor, of Asia Minor, he collected an army of 100,000 men, 13,000 of whom were Greek auxiliaries noted for their bravery. He marched eastward, intending to overthrow his brother and seize the throne. Artaxerxes gathered an army and met him on the plains of Cunaxa (401 B. C.). In the fight Cyrus was slain and his army routed, with the exception of the Greeks, who not only had held their own but broke their way through all opposed to them. The retreat of the Greek soldiers and their great sufferings are immortalized by Xenophon in the *Anabasis* (which see).

CZAR, *zahr,* a corruption of the Roman word *Caesar,* is the title of the emperor of Russia. It was first adopted in 1547 by Ivan the Terrible. The Russian empress is styled the *czarina,* and the heir apparent is called the *czarevitch.* The same title is seen, in a different form, in the word *kaiser,* applied to the emperor of Germany. King Ferdinand of Bulgaria also styles himself czar of the Bulgars.

CZECH, *check,* a Slavic race occupying parts of Bohemia, Moravia, Silesia and the northern portion of Hungary. Their total number is at

present estimated at about 7,100,000. At one time all the Slavic peoples had one common tongue; the Czechs, however, have gradually evolved a separate language which has absorbed many German words, but still bears a resemblance to old Slavic. The spoken language is considered very musical and has a wide variety of sounds. Three centuries ago the Czechs were a prosperous nation, but they fell under the power of Austria and their nationality was lost. At the outbreak of the War of the Nations in 1914 the Czechs were placed in the curious position of being called upon to fight for a country from which they had long been endeavoring to free themselves; their sympathies were largely Russian, but they were politically Hungarians. The prosperity they have attained may be said to be in spite of the Austro-Hungarian governments rather than with their assistance.

CZERNOWITZ, *cher'no vits,* capital of the Austrian province of Bukowina, near the River Pruth, about 164 miles southeast of Lemberg. It is a town of considerable commercial importance, with manufactories of machinery, oil and lumber and many breweries. The population is very mixed, consisting of Germans, Ruthenians, Poles, Rumanians and Jews, and holiday crowds, in their varied garb, are very picturesque and interesting. The Austrian occupation, which took place in 1775, made a great change in the appearance of the town. It now possesses many handsome buildings, a flourishing university with over 1,000 students and well-equipped trade and industrial schools. The city was captured by the Russians in the early stages of the War of the Nations, in 1914, lost by them to the German-Austrian forces later, and again taken by the czar's army in the summer of 1916. Population in 1910, 87,128.

THE WORLD BOOK
ORGANIZED KNOWLEDGE IN STORY AND PICTURE

Dd

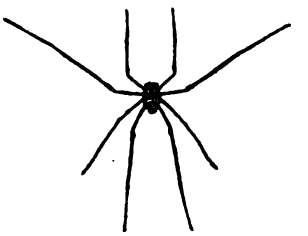
D, the fourth letter in the English alphabet, which was developed from the Greek Δ or *delta*, written in the form of a triangle. When the Greeks adopted this letter they changed its name from *daleth*, meaning *door*, to *delta*. The Phoenicians called the character *daleth*, or *door*, because it resembled the door of a tent, a familiar object at all times to those peoples. To make the sound of *d* the tip of the tongue is touched to the roof of the mouth and the breath is then forcibly expelled.

In Roman notation *D* represents 500 and with a horizontal stroke over it ($\overline{D}$) it stands for 5,000. In music it is the second note in the natural scale of C, and is the third string of the violin.

DACHSHUND, *daKhs'hoont*, a long-bodied, short-legged dog of German origin, once used in Central Europe almost solely for hunting badgers but now kept as a pet in households of many countries. It is a sturdy animal, with strongly-developed muscles. This strangely-formed dog has been humorously described as being "a dog and a half long and half a dog high." It has a long, round body, with short, thick, somewhat crooked legs; its paws are turned outward, and it has a long, conical head, tapering toward the nose. The broad, rounded ears are long and drooping, and the tail is long and tapering. This type of dog has many admirers. The coat of most dachshunds is short, thick and silky, of a reddish-brown tint, but sometimes is black and tan, gray and tan, or spotted. A variety late in becoming popular is rough-coated.

THE DACHSHUND

DADDY-LONG-LEGS, a term applied in America to the *harvestman* or *grandfather greybeard*, a harmless, spiderlike insect with an oval body and long, slender legs. These legs are bent in the middle, so when it walks its body almost touches the ground. Its food consists of small insects.



DADDY-LONG-LEGS

In England the term signifies the *crane fly*, which also has long, slender legs, but has wings and resembles a mosquito. A species of crane fly which lives in the earth destroys grains and grass, and is found in the United States and Canada as well as in England.

DAEDALUS, *ded'a lus*, a sculptor, architect and artisan of Greek mythology, worshiped by ancient artists' guilds as the personification of art and as the inventor of carpentry and many tools. The name is from the Greek, and means *the cunning worker*. Through jealousy, according to the myth, Daedalus killed his nephew and pupil, Talos, and was obliged to

flee from Athens to Crete. There he built the famous labyrinth and Ariadne's dancing-place, both of which have been unearthed by modern excavators. Later, having offended the king, he and his son, Icarus, were imprisoned. To effect an escape, Daedalus made two pairs of wings which they fastened on their shoulders. According to the myth, Icarus fell into the sea, because he flew so near the sun that the wax fastening the wings was melted. Daedalus landed safely in Sicily, where he built several famous temples.

DAFFODIL, *daf' o dil,* an old-fashioned, ever-popular, early spring flower, a species of narcissus. It is a native of Europe, where it grows wild in woods and hedges, but it is extensively cultivated in America, Holland and England. There are various forms of daffodils. The best known is the trumpet daffodil, which inspired Shakespeare, Milton, Wordsworth and many other poets, and whose gay blossoms, masses of captured sunshine, bring to mind the chant of English children—

Daffy-down-dilly, just come to town
With a yellow petticoat and a green gown.

This species bears a long, yellow tube with a crinkly edge, surrounded at the base by long

Daffodils,
That come before the swallow dares, and take
The winds of March with beauty.
SHAKESPEARE: *Winter's Tale.*

yellow petals. One flower appears at the end of each stalk, standing out at right angles. The narrow, bluish-green leaves are nearly flat, and six grow about each flower stalk. The Van Sion is the best double daffodil listed in catalogues.

Daffodil bulbs should be planted in autumn or early winter and should be placed four inches deep and about three inches apart in free, open soil. Blossoms will appear in April. If kept indoors for winter-blooming, flowers are produced in January. See NARCISSUS.

DAGUERROTYPE, *da ger' o type,* the name given to the first practical photographic invention, perfected by Daguerre in 1839. The

IN MEMORY OF DAGUERRE
Monument in the National Museum, Washington, D. C.

process was far more complicated than any involved in modern photography, and the results obtained would now be considered most commonplace. At the time, however, it caused a great sensation in the scientific world. The process consisted in first sensitizing a polished copper plate by coating it with chemically pure silver. Then the plate was submitted to the action of vapor of iodine; following this it received further treatment with vapor of bromine. After exposure in a camera the image was developed in vapor of mercury, and the plate was immersed in a solution of hyposulphite of soda to render the result permanent. The finished picture was not much in-

ferior to the later "tintype," both being printed on thin copper plates (see PHOTOGRAPHY).

Louis Jacques Mandé Daguerre (1789-1851), a French artist and scene painter, famous as the inventor of the original photographic process described above. Although he has received all the credit of the invention, it is known that he had long corresponded with other Frenchmen who were conducting researches along the same lines; one who was approaching success died before his discovery could be announced. In recognition of his work Daguerre was made an officer of the Legion of Honor and was given a pension of 6,000 francs by the French government.

DAHLIA, *dahl'ya*, or *dale'ya*, a hardy plant of the composite family, at one time considered coarse and common, but of late appearing in such improved varieties that its wonderful development attracts almost as much attention as the chrysanthemum. It was named after the Swedish botanist, Dahl. Though a native of Mexico, the dahlia is now extensively cultivated in the United States, Southern Canada and Europe. Originally a flower with eight red rays about a yellow center very stiff and formal, the dahlia is now produced in almost every imaginable color, some compact and ball-shaped, others with long, flat petals; and the most interesting and beautiful, the cactus dahlias, have double blossoms with long, twisted petals.

DAHLIAS

Dahlias planted in May in rich soil will come to blossom in July. They must have plenty of water, a bucket a day for each plant being necessary if the season is dry. The water should be poured about the main stalk, not over the soil surrounding the plant. In case the soil is only moderately fertile it should have an application of fertilizer in the middle of the summer. As the stalks of these plants are very brittle, they should be tied to strong stakes; otherwise, a hard wind or a violent downpour of rain may break them. If the stakes are painted green they will tone attractively with the foliage. See COMPOSITE FAMILY.

DAHOMEY, *dah ho'may*, or *dah ho may'*, a French colony in West Africa, formerly an independent kingdom ruled by a monarch whose power was absolute. The French obtained possession of it in 1892, during the period in which the European powers were dividing Africa among them; the army captured Abomey, at that time the capital, deposed the king and proclaimed a French protectorate. Population, estimated at over 1,000,000.

It covers an area of about 60,000 square miles and is therefore a little larger than the state of Florida. The climate is hot and unhealthful for Europeans, as it is only from 7° to 10° north of the equator, and the average temperature is over 80° F. For about fifty miles from the coast the land is flat and swampy. It then gradually rises to a plateau about 1,600 feet above sea level. The soil is fertile and good crops of manioc, yams and cotton are raised. Horses and cattle thrive in the more elevated districts. The chief source of revenue is in the palm, which produces great quantities of palm oil and kernels. Dried fish also forms an important article of commerce, great quantities being exported through the British port of Lagos. The forests contain the baobab, tamarind, fig and other fruit trees. Lions are found in some parts and the elephant and hippopotamus have not yet disappeared.

LOCATION OF DAHOMEY

Kotonu and Whydah are the chief ports, other important towns being Abomey, Grand Popo, Agoue, Allada and Porto Novo, now the capital. The colony is administered by a lieutenant-governor, assisted by a council. The inhabitants are pagans of negro stock. They worship fetishes, and human sacrifices, formerly common, are still offered in isolated districts beyond the direct influence of the ruling whites. Early in the nineteenth century Dahomey was an important power in Africa, and it conquered many neighboring tribes with the help of its army of Amazons, female warriors noted for their bravery.

DAIRYING, or DAIRY HUSBANDRY, is that branch of agriculture which deals with milk and its products. In the various countries of the world local physical conditions have determined in each case the animal best suited for dairy purposes. The Arabs of the deserts obtain milk from their camels, and the Laplanders of the North keep reindeer for their milk. Some of the Tartar tribes of Asia to this day keep mares for their milk, and in many parts of the temperate regions the milk of goats and sheep is a staple article of food. In India the natives get their supply of milk from the buffalo. But of all the animals whose milk is used for food the cow is the most common, and it is the only one which need be considered here. The dairying industry is concerned exclusively with cows.

Dairy Management. To conduct a dairy successfully requires a variety of knowledge and careful attention to certain principles of management. Careful selection of the herd, properly-constructed stables and other buildings, proper feed and pasturage, and lastly, facilities for storing and marketing the product, are the principal points to be considered.

The Herd. The cows should be selected with reference to the main purpose for which the dairy is conducted. If the dairy supplies milk to city markets, the quantity of milk produced should be the determining factor, and if the dairy supplies butter the percentage of butter fat in the milk should be the principal factor to consider. It is the general experience of dairymen that the Holsteins and Ayrshires, being cattle whose milk contains only small globules of fat, produce large quantities of milk. The Jerseys and Guernseys, on the other hand, provide milk which is much richer in fat, and are therefore the best breeds if the dairy is primarily a butter producer.

On a good dairy farm a daily record is kept of the amount of milk obtained from each cow. Any cows which do not maintain the required standard should be sold or fattened for beef and their places taken by other animals. Only the calves from the best milkers should be retained for additions to the herd. In this way the herd will be strengthened from year to year. The record should give the daily quantity of milk given by each cow, as well as the total for six months or a year. The most profitable cows are those which give a uniform quantity over a long period of time. The record should also include the results of tests for the amount of butter fat. These tests should be made by experts, if possible, but if this is out of the question the dairyman can get directions and assistance from any agricultural experiment station.

The Stable. The proper housing of cows is usually the most important factor in preserving their health. Tuberculosis and other diseases are frequently the result of filthy and poorly-ventilated stables. The stables should be well-lighted, and should always have an abundance of fresh air. The walls should be kept free from accumulations of dust, and should be whitewashed frequently. The floors should be kept clean and should be covered with fresh litter every day. Partitions made of piping or iron railing are better than wooden ones, because they catch less dust and are easier to clean. The grounds in the vicinity of the stable should be kept as clean as the interior, and rubbish or manure heaps should not be allowed to accumulate.

The Feed Problem. Fresh grass is generally regarded as a most desirable feed for milch cows, but it seldom happens that the available pasturage is sufficient to feed a large herd. Some other source of food supply must be available at all times of the year, and during the winter months the cows must be fed entirely from this other source. Once the proper ration is determined, the most economic method of supplying it should be installed. Most farmers now use ensilage, or silage, as it

is more commonly called, and the silo is a conspicuous feature in almost all farm landscapes. Full details of its variety and use are given in the article SILO.

Cleanliness a Necessity. Probably no other farm product is as easily spoiled or tainted as milk. It is very sensitive to its surroundings, readily absorbs particles of matter from the atmosphere, and even absorbs odors from articles near it. Tiny particles of dirt, moreover, may contain bacteria, which may render the milk dangerous or may leave it merely disagreeable to the taste. The cows should be milked in their stalls. Sweeping or littering the cows before milking should be avoided, because these operations raise dust which may contaminate the milk. It is desirable, however, to change the air in the stable a short time before, so that it may be fresh and pure. The milkers should wear clean clothing, and their hands should be clean and dry. The flanks and udders of the cow should be wiped with a damp cloth, to remove any dirt which might otherwise fall into the pail. The old-fashioned, wide-topped pail should be avoided; those with small tops, partly covered, are the best. All utensils used in the handling of milk should be cleaned immediately after using and be scalded with boiling water. A still better plan is to steam them in a vat for several minutes. Wooden pails should not be used.

Development of the Industry. The dairy industry, as a special branch of agriculture, is of nineteenth-century growth, especially in Canada and the United States. Long before 1800, in many parts of the world, cows were being kept for their milk, but the individual farmer kept only as many cows as he needed to supply milk, butter and cheese for his family. Dairy farming to-day, on the contrary, is a specialty, and a comparatively small number of farmers supply millions of consumers.

While the industry has been growing, it has also undergone a complete change in character. In the beginning of the nineteenth century it was believed that dairying was limited by physical and climatic conditions to a small part of North America, called the "dairy belt." It was confined, also, to spring and summer, when pasturage could be obtained. Cows were usually allowed to go dry in the winter, and winter dairying was practically unknown. Under the system now employed, however, good milk, butter and cheese can be obtained, by proper management, in almost every part of North America. Cows are well-housed in the winter, and give milk practically the whole year around.

Importance of the Industry. *In the United States.* Although it is true that many farmers make dairying their principal source of income, yet there are thousands who keep only a few cows, to supply milk, butter and cheese for their families. As most of the latter group keep no accurate records of production, the census figures showing the amount and value of dairy products are somewhat smaller than they should be. The varying conditions under which the industry is carried on in different sections make it hard to find a satisfactory basis for grouping the sections or individual states in the order of their importance. There is no doubt, however, that in the Eastern states dairying is the principal source of income of most of the farmers who own cows. This is also true through the Central West. In the far Western states many farmers still keep cows primarily for beef purposes.

New York and Wisconsin are now the foremost dairy states in the Union. They have the largest number of milch or dairy cows, the largest production of milk, and they lead in the total value of products. Wisconsin, with about 1,700,000 dairy cows, is closely followed by New York, Iowa, Illinois, Minnesota, Texas and Pennsylvania. In the census of 1910, ranked according to the quantity of milk produced, New York was followed by Wisconsin, Iowa, Pennsylvania, Minnesota, Illinois, Ohio and Michigan. The total production of milk in the United States was then about 7,500,000,000 gallons a year. New York's annual output of dairy products was nearly $82,000,000, about one-eighth of the total for the United States. Next in order came Wisconsin, $56,000,000; Pennsylvania, $45,000,000; Illinois, $34,000,000; Iowa, $34,000,000; Ohio, $33,000,000; Minnesota, $31,000,000; Michigan, $28,000,000; and California, $24,000,000. It must be understood that these figures vary considerably from year to year. One of the most striking features of the dairy industry in recent years is the development of the factory system in the making of butter and cheese. This feature is discussed in the article CREAMERY.

In the Dominion of Canada. Dairying was naturally one of the first branches of agriculture practiced by the early colonists. The farmers of New Brunswick and Nova Scotia were famous at an early day for the excellence of their dairy products. As settlement spread

westward dairying kept pace with them, and as early as 1852 cows were kept with success at Fort Simpson. At Fort Good Hope, just outside the Arctic Circle, and at York Factory, on Hudson Bay, as well as other remote points, cows have been kept for many years. These examples merely show the widespread character of the industry. Ontario is still, and has been for over half a century, the center of dairying. It has over 1,000,000 milch cows, more than one-third of all the milch cows in the Dominion, and its annual output of milk is nearly half that of the Dominion. Ontario's output is approximately 4,500,000,000 pounds, or 2,250,000,000 quarts of milk a year; the Dominion yield is about 10,000,000,000 pounds, or 5,000,000,000 quarts. Quebec is not far behind Ontario, having over 800,000 milch cows and an annual output of 1,500,000,000 quarts of milk a year. Ontario and Quebec together furnish about seventy per cent of the Dominion's output of milk. A conservative estimate places the annual value of all dairy products at $100,000,000, an increase of more than sixty per cent since 1900. Most of these products are made for domestic consumption, but over $20,000,000 worth of cheese is exported each year, all but one per cent being sold to Great Britain and Ireland. Canadian cheese is famous the world over. E.H.F.

Consult Gurler's *American Dairying;* Lane's *The Business of Dairying.*

Related Subjects. For more detailed information as to the various phases of dairying the following articles in these volumes should be consulted:

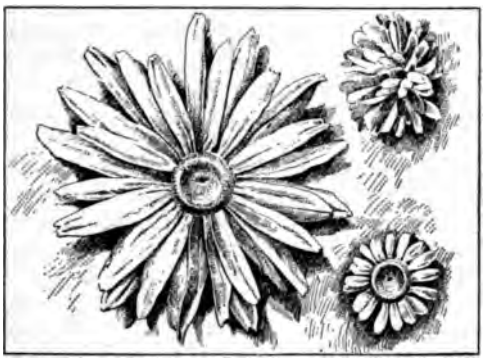
Agriculture	Creamery
Barn	Cream Separator
Butter	Disease
Buttermilk	Subtitle *Diseases of Animals*
Cattle	Milk
Cheese	Silo and Silage
Churn	
Cow	

DAISY, "the poet's darling," a familiar and favorite flower in Europe and America. The typical daisy is pure white and single, with a yellow or brown center. In Europe it grows commonly in all the fields and meadows,

"And open pastures, where you scarcely tell
White daisies from white dew."

In the United States and Canada the white daisy, a species of wild chrysanthemum, though a delight to the eye and loved by the children, is the farmer's pest, which must be killed off if he is to have hay. Without any care or attention this little flower will grow and spread and choke out other plants, so to the farmer or gardener it is a weed, the *white-weed* (see page 861); but to the florist it is the popular, hardy *marguerite.*

Many improvements have been wrought in the daisy, some now being double, and there is a great variety of colors. Burbank's Shasta



BURBANK'S SHASTA DAISY
The flower has a diameter of four inches. It was developed from the parent blossoms shown at right and drawn to scale.

daisy, four inches across, with large pure-white petals, is especially admired in garden borders and for house decoration.

In the United States the name is loosely applied to other flowers, such as the *black-eyed Susan* and some wild *asters.* This "unassuming commonplace of nature" was the emblem of love and fidelity in the days of chivalry, but in modern flower language the daisy represents simplicity and modesty. See OXEYE DAISY; BLACK-EYED SUSAN.

DALHOUSIE, *dal hoo' zi,* the county town of Restigouche County, N. B., situated at the mouth of the Restigouche River, on Chaleur Bay, sixteen miles east of Campbellton. Its harbor is well protected and is large and deep, having a depth of twenty-four feet at the wharf. There is steamship connection with other ports on the coast, and railway connection by a branch of the Intercolonial Railway. Dalhousie is noted for the scenery in its vicinity; everywhere are splendid forests of spruce, pine, cedar and maple. These forests also provide material for the town's lumber and shingle mills, the chief industrial establishments. The commercial fisheries and fish-packing are second only to the industries dependent on the forests, and many anglers also make Dalhousie their headquarters. Population in 1911, 1,650; in 1916, estimated, 1,900.

DALHOUSIE UNIVERSITY, at Halifax, N. S., a coeducational, undenominational institution for higher education. It has a larger

endowment, student body and number of professors and instructors than any other university in the Maritime Provinces. The teaching staff numbers about eighty, and there are about 400 students. Degrees are awarded in arts, science, music, law, pharmacy, medicine and dental surgery. In music the practical instruction given at the Halifax Conservatory of Music and other approved schools is accepted as a part of the required work; the university offers only historical and theoretical work. In pharmacy the Nova Scotia College of Pharmacy is similarly affiliated. Other affiliated institutions are the Presbyterian College, Halifax Ladies' College, Convent of the Sacred Heart and Mount Saint Vincent Academy, all at Halifax, and Prince of Wales College, at Charlottetown, Prince Edward Island.

DALLAS, *dal'as*, TEX., the leading industrial city of the state, ranking next to San Antonio in population. According to an estimate in 1916 the population was 124,527, an increase of 32,423 since 1910. About eighteen per cent of the entire population are negroes. The city is situated on the Trinity River, in the northeastern part of the state, and in Dallas County, of which it is the county seat. Forth Worth is thirty-one miles west, and Austin, the capital, is 210 miles southwest. Dallas has the Missouri, Kansas & Texas; the Texas & Pacific; the Texas & New Orleans; the Gulf, Colorado & Santa Fe; the Frisco; the Chicago, Rock Island & Gulf; the Saint Louis South Western; the Missouri, Oklahoma & Gulf, and the Houston & Texas Central railroads. Besides, there are five electric interurban lines in operation to Denison, Waco, Corsicana, Fort Worth and Cleburne, respectively. In 1841 the first settlement was made, and in 1866 it was incorporated as a city and named for George Mifflin Dallas, Vice-President of the United States under James K. Polk. The area of the city is nearly sixteen and one-half square miles.

Parks and Boulevards. The city provides ample recreation grounds, 713 acres being divided into twenty parks, of which City Park, Fair Park and Forest Park, with its "zoo," are especially attractive. Oak Lawn, Cliff, Turner and Central parks are among the other beauty spots of the city. There are also many well-equipped playgrounds. Dallas has handsome residences and fine streets, and improvements are still in progress, a boulevard system about sixty miles long being under development in 1917. Oak Cliff, on the west side of Trinity River, is one of the residential districts. In 1903 it was annexed to the city, with which it is connected by one of the longest concrete viaducts in the United States, completed in 1912 at a cost of $657,466.

Commerce and Industry. The surrounding region is a part of the black-waxy belt, famous for its agricultural products, especially cotton. Dallas is the largest inland cotton market in the United States, 1,500,000 bales being handled annually. It is also a leading center for the manufacture of harness, saddlery and cotton-gin machinery, and a distributing center for agricultural implements. The city is also the distributing center of the Southwest for automobiles, two assembly plants being located here. Among other important industrial enterprises are flour mills, cement plants, oil refineries, iron and metal works, cottonseed-oil mills, cotton compresses, packing houses and grain elevators.

Public Buildings. The city has a number of noteworthy buildings, the most prominent being the Adolphus Hotel, erected at a cost of $1,600,000, the county courthouse, the $500,000 municipal building, which contains thirty-five acres of floor space, the Pretorian building, the Wilson building and the Federal building; the last-named was erected in 1883 at a cost of $11,000, but a site has been purchased for a new building which will cost about $250,000. In 1914 Dallas was chosen as the location of a Federal Reserve Bank. The state fair of Texas has been held here annually since 1886. Its handsome permanent buildings are constructed of reinforced concrete, and of these the Coliseum, having a seating capacity of 5,000, is the largest. This fair is unique in its organization, as it accepts no aid from the state, and devotes its receipts to defraying the expenses of the fair and to the improvement of the fair grounds, which belong to the city.

Education. Dallas is the seat of two universities, Dallas University and the Southern Methodist University, the latter of which has 625 acres of grounds and an endowment of $2,000,000. These, with Saint Mary's Academy, Saint Edward's College, Patten's Seminary, Saint Joseph's Academy, Terrell School for Boys, five business colleges, about fifty private schools, thirty-two public schools, two medical colleges and a Carnegie Library, comprise the educational institutions of the city.

Churches and Institutions. Dallas is the see of Roman Catholic and Protestant Episcopal

dioceses There are more than 100 places of worship, about thirty being for negroes. The most notable churches are the cathedrals of Saint Matthew and of the Sacred Heart. Three orphanages offer shelter to the homeless children of the city and two homes are for aged women. There are twelve hospitals, three rescue homes and several other benevolent institutions.

Government. In 1907 Dallas adopted the commission form of government, which is vested in a mayor, and four commissioners in charge of water works and sewerage, finance and revenue, police and fire, and streets and public property, respectively. R.H.

DALLES, *dalz,* a name derived from the French *dalle,* meaning *trough,* or *drain,* was applied by French explorers in America to rocky gorges through which rivers flow at great speed. There are several in North America, among which are the picturesque dalles in Wisconsin, near Kilbourne; the Saint Louis dalles, a series of cataracts in the Saint Louis River, near Duluth, Minn.; the Saint Croix dalles, in the same state; and the famous dalles of the Columbia River, which have given the name *The Dalles* to the oldest town in Oregon.

The dalles of the Columbia begin five miles above the town and extend up-stream from that point for nearly eight miles. Within this distance there is a fall of eighty feet, including a sheer fall of twenty feet at the upper, or eastern, end. This fall is known as the *Celilo,* but the Indians and pioneers called it, more picturesquely, *Turnwater.* At the western end is the Big Eddy, terminating what is known as the Long Narrows or *les grandes dalles.* This latter is a channel cut by natural forces through perpendicular walls of basaltic rock. It is 9,000 feet long and from 135 to 300 feet wide, and at low water the distance from the top of the wall to the water is fifty feet.

Through this gorge, which is so workmanlike in appearance that it seems to have been constructed by the hand of man, the entire volume of the river rushes, and the water boils and surges so violently that the river seems, so to speak, to be turned on edge. Beyond this stretch to Celilo Falls there are powerful currents and numerous eddies; the dalles are therefore an impassable barrier to navigation. To overcome this obstacle, the United States government has constructed a canal and lock system at a cost of $5,500,000, which was opened to commerce in 1915. See COLUMBIA RIVER. L.D.C.

DALMATIA, *dal ma'she a,* the most southerly of the Austrian provinces, bordering on the Adriatic Sea. It covers an area of 4,940 square miles, and is therefore about the same size as the state of Connecticut. Because of

LOCATION OF DALMATIA
The southernmost extension of peculiarly-formed Austria. (See map, page 497.)

a generally-mountainous surface agriculture is in a very backward state, though the valleys in the south produce olives, grapes, figs and other fruits. Dalmatia is noted for the production of *maraschino,* a liquor made from a cherry peculiar to that country. The trade is not very extensive and is confined to coast towns, the most important of which are Zara, the capital; Cattaro, with one of the finest harbors in Europe, Spalato, and Ragusa. The fisheries are important, the catches of tunny and sardines being particularly valuable. Dalmatia was proclaimed an Austrian province in 1815. Population in 1912, 660,336.

DALMORES, *dal mo rez',* CHARLES (1872-), a noted French tenor, who was born at Nancy, France, and received his musical education at the Paris Conservatoire. Before he discovered that he was the possessor of a voice which promised a career, Dalmores devoted much time to the violoncello. He made his debut as a singer at Rouen, in 1899, with such success that after three years he was engaged to appear in Brussels at the Theater Royal. His Brussels triumphs were repeated at Covent Garden, London, and at Bayreuth, Bavaria. In 1906 he first appeared in the United States as

CHARLES DALMORES

a member of the Manhattan Opera Company, New York. Since then he has been identified with the Philadelphia-Chicago Opera Company and is generally recognized as one of the best of the younger French tenors. Among the many rôles which he has to his credit he has won greatest renown as Don José in *Carmen,* Samson in *Samson and Delilah,* Romeo in *Romeo and Juliet,* and Hoffman in the *Tales of Hoffman.*

DAM, an artificial barrier to the flow of water, is a device older than history. Nevertheless, it is just entering on a period of usefulness until recently little suspected. The great Assuan dam has added several hundred square miles to the arable lands of Egypt; it holds back thousands of millions of gallons of the water of the Nile, to be used in irrigation. The dam at Bassano, in Alberta, is a part of the largest irrigation system in America. The Arrowrock dam, in Idaho, the highest dam in the world, is one of several new irrigation dams which store billions of gallons of water for the United States irrigation service. The Croton dam, one of the highest masonry dams, controls New York City's water supply. The dam across the Mississippi River from Illinois to Keokuk, Iowa, generates half as much electric power as Niagara. Another important dam is the Gatun, which maintains the level of water in the Panama Canal. All of these great dams have been completed in the present century.

The earliest dams were earthen, and many modern dams, including the Bassano and Gatun dams, are built largely of earth. Timber, in the use of which the beavers anticipated man, makes a very durable dam, but one not suited for high structures. Steel has been used in a few dams. As the pressure of the water against a dam is in direct proportion to its depth, the highest dams are built of masonry or concrete. The Arrowrock, 354 feet high, is of concrete; the Shoshone, in Wyoming, 328.4 feet high, is the world's highest masonry dam.

The dikes of Holland, the levees of the Mississippi and the artificial banks of the Yellow River in China are dams built, not to utilize water, but to prevent damage from floods.

Related Subjects. Wider information on the topic of dams may be gained from the following articles in these volumes:

Alberta	**Irrigation**
Aqueduct, (Illustration)	**Jetty**
Assuan	**Keokuk Dam**
Canada	**Levee**
Idaho	**Mississippi River**

DAMASCUS, *dam as' kus,* one of the most ancient cities of the world, now the capital of the Turkish province of Syria, in Asia. Practically nothing is known of its origin; but that it was a place of some importance even in the days of Abraham is indicated by Biblical references (see *Genesis* XIV, 15). There still stands, according to some authorities, the house of Naaman, the leper, who thought the waters of the River Abana better able to wash him clean than those of the Jordan (*II Kings* V). The Abana, now called the Barrada, still waters the beautiful gardens and orchards of Damascus. Towards this city Paul was proceeding when he was halted by the blinding light of conversion. There, in "the street called Straight," still stands the house of Judas, in which the disciple Ananias found the penitent apostle (*Acts* IX).

OLD EAST GATE AND WATCH TOWER

As of old, the streets are still mean and narrow, the outside of the houses gloomy, forbidding, and in many cases unsanitary. The interior of the better-class dwellings, however, is in contrast with the sordid exterior. Beautiful courts paved with marble, ornamented with trees and shrubs, fountains spraying cooling waters, and refreshing shade await the visitor who passes through the outer door. Many homes are furnished in luxurious style, with not a few modern Western appointments, yet Damascus remains the most Oriental in manners and customs of all Eastern cities. To the visitor the bazaars of Damascus are of intense interest. They consist of small stores on each side of covered streets, very similar to modern arcades.

Damascus is now a busy city, and houses that once shook to the martial tread of Syrian hosts now look down on modern street car lines. Once a stronghold of Christianity, Damascus is now holy city of the Moslems, where vast numbers annually meet for the pilgrimage to Mecca. It is also an important center of Oriental trade, noted for its production of silks, damask and cotton fabrics. The sword blades for which the city was famous for centuries are no longer made there (see *Damascus Steel,* below). Damascus has had probably the most eventful history of any Eastern city. In turn under the power of the Syrian, Israelite, Persian, Greek, Roman and Crusader, it fell at last into the hands of the Turks, who captured it in 1516. Population, estimated, 250,000.

Damascus Steel, a steel of high quality, originally produced in Damascus and other cities of the East, of special value in making highly-tempered sword blades. Its extraordinary hardness and elasticity were produced by careful and laborious forging, doubling and twisting of the steel, which contained more carbon than other steel. The sword blades of Damascus were richly ornamented with designs that penetrated completely through the metal without in any way affecting its strength and temper. F.ST.A.

DAM'ASK, originally a "flat-figured satin" in which the weft was woven into the warp in such a way as to make figures such as fruit, flowers, leaves and other forms. The name was given the fabric from Damascus, the city where it was first manufactured. The varieties now most widely known are the linen damasks used for tablecloths and napkins, so desirable for their beautiful, soft, satiny luster. The best of these are made in Germany, France, Scotland and Ireland. Handsome and expensive furniture coverings are damasks of silk and of wool.

DAMOCLES, *dam'o klees,* a courtier and flatterer of the tyrant Dionysius of Syracuse. His extravagant description of the happiness of kings caused his royal master to read him a lesson. He was invited to a sumptuous banquet and was seated at the table in royal luxury. On looking up, he was horrified to find a sword suspended by a single hair [illegible] his head. Dionysius thus desired to em[illegible]e the uncertainty of his life, even when [illegible]eming security. The "sword of Damocles" [illegible]ecome into vogue as an expression referring [illegible]pending or dreaded tragedy that may happen at any moment. See DIONYSIUS THE ELDER.

DAMON, *da'mun,* AND PYTHIAS, *pith'i as,* two noble youths of Syracuse, whose love for each other, recorded in a popular legend, is universally regarded as the highest ideal of friendship. Pythias, or Phintias, had been condemned to death by Dionysius, tyrant of Syracuse. He secured permission to leave the city to put his affairs in order, Damon offering himself as a pledge for his friend's return, to suffer death himself in place of Pythias should the latter fail to keep his promise. Pythias, unexpectedly delayed, arrived just in time to save Damon from death. It is said that Dionysius so admired the spirit of friendship animating the two that he immediately pardoned Pythias and besought the two youths to become his friends. This incident is the basis of the principles on which the fraternal order The Knights of Pythias was established (see PYTHIAS, KNIGHTS OF).

DAMROSCH, *dahm'rosh,* the name of a family, originally German, two members of which have played an important part in the advancement of music in the United States.

Leopold Damrosch (1832-1885) was born in Posen, Prussia, and was educated for the medical profession, in accordance with his parents' wishes, at the University of Berlin. In 1854, shortly after he had begun practice in Posen, he took up the formal study of music, to which he was devotedly attached, and in 1855 entered upon the career of a concert violinist. After serving as director in Posen and in Breslau, he emigrated to America in 1871, and began a brilliant career in New York City. He founded the Oratorio Society in 1873, the Symphony Society in 1877, and organized several large musical festivals.

To Damrosch alone is due the honor of permanently establishing choral societies in New York; but he achieved the crowning glory of his career when, in 1884, he successfully introduced German opera at the Metropolitan Opera House. In this great theater his funeral services were held a year later. He also won distinction as a composer of cantatas, pieces for the violin, songs, and a festival overture.

Walter Johannes Damrosch (1862-), son of Leopold, continued the work which his father had begun. He was born in Breslau, Prussia, studied piano and harmony, and in 1871 accompanied his father to America. In 1881 he was appointed organist of Plymouth

Church, Brooklyn, and four years later, on the death of his father, succeeded him as director of the Oratorio and Symphony societies. The Damrosch Opera Company, founded by him in 1894 for the production of Wagner's music-dramas, toured the United States for several seasons.

Between 1900 and 1902 he conducted the German operas at the Metropolitan Opera House, in 1902 began a season with the Philharmonic Society, and in 1903 brought about the reorganization of the New York Symphony Orchestra as a permanent orchestra. This organization is now one of the best of its kind. The compositions of Damrosch include two operas, *The Scarlet Letter* and *Cyrano de Bergerac*, a *Te Deum*, a sonata for violin and piano, and several songs.

DANA, *da'na*, CHARLES ANDERSON (1819-1897), for twenty-five years the most noted of American journalists, was born at Hinsdale, N. H. While working in his uncle's store in Buffalo he prepared himself for Harvard College and entered in 1839, but was obliged to leave after two years on account of trouble with his eyes. In 1842 he became a member of the Brook Farm Association and edited *The Harbinger* in Boston in its interest (see BROOK FARM). In 1847 he joined the staff of the New York *Tribune* and later became its managing editor, resigning from this post on account of differences of opinion with Horace Greeley regarding Mexican War policies. During the latter part of the War of Secession (1863-1864) he was assistant Secretary of War under Stanton. After the war he edited the Chicago *Republican* for a time, but it failed and he returned to New York.

In 1868 he became part owner and editor-in-chief of the New York *Sun*, holding this position during the remainder of his life and conducting its interests and policies with such remarkable success as to raise its valuation to $5,000,000. "If you see it in the *Sun*, it's so," he made the slogan of that journal. The *American Encyclopedia* was edited under his direction, and he also collaborated with General J. H. Wilson in a *Life of Grant*. Dana possessed keen judgment and brilliant intellect and his editorials in the *Sun* were widely read for their literary quality.

DANA, JAMES DWIGHT (1813-1895), an American geologist and one of the most eminent scientists of the nineteenth century. In his early school days in Utica, N. Y., his birthplace, he eagerly devoted himself to the study of the natural sciences. After graduating from Yale in 1833, he was appointed instructor in the United States navy. This position gave him unusual opportunity for travel and investigation. As a member of the Wilkes Exploration Expedition (1838-1842), sent out by the United States government to explore remote parts of the Pacific Ocean, he made many interesting discoveries concerning marine animals, which he later described in books and reports. From 1855 to 1890 he served as professor of natural history at Yale, and for forty-nine years was editor of the *American Journal of Science*, in which many of his papers were published. Among his noted works are *System of Mineralogy, Manual of Geology, Text-Book of Geology, Coral Reefs and Islands* and reports on *Zoöphytes, Geology* and *Crustacea*.

DANA, RICHARD HENRY (1815-1882), the author of *Two Years Before the Mast*, one of the immortal books of American literature for boys. From his earliest boyhood Dana had a passion for the sea, and except for powerful pressure from his family, would have entered the United States navy. Yielding to their wishes he entered Harvard College, and was apparently started on the beaten path which would have made him a distinguished Boston lawyer. In later life he did become one of the foremost American authorities on international law, but his work as a lawyer will be long forgotten when *Two Years Before the Mast* still has a place in the heart of every boy.

At nineteen Dana was a junior in college, when failing eyesight forced him to give up his studies. He shipped on the brig *Pilgrim* for a two years' cruise around Cape Horn and along the west coast of North and South America. His father, also Richard Henry Dana (1787-1879), a lawyer and poet of reputation, possessed social prominence and independent means, and young Dana might have gone on a pleasure cruise, a gentleman in search of health. Instead, he shipped as a common sailor, and for two years there was no burdensome task, no harsh treatment, no stormy weather which constituted the routine for the common sailor, that he did not know at first hand. At twenty-two, he wrote the story of these years, probably the most accurate record of a sailor's life ever written. It has not only the value of a record, but it has the touch of imagination, of the wonder and mystery of the sea which will make it a living book so long as sea and sky endure. It was distributed by

the Admiralty throughout the British navy, and to-day it has a place in the library of every American man-of-war.

DANBURY, CONN., a city famous for more than a century for the manufacture of men's hats. It is one of two county seats of Fairfield County, Bridgeport being the other, and is situated on both banks of the Still River, in the southwestern part of the state, five miles from the New York state line. New York City is sixty-five miles southwest; Waterbury is thirty miles northeast. The Danbury & Highland division of the New York, New Haven & Hartford Railway serves the city, and trolley lines operate to Bethel and East Danbury. In 1916 the population was 22,556, an increase of 2,274 since 1910. The area is five square miles.

The region in which Danbury is located is a picturesque, mountainous country, with good roads, and valleys and lakes for camping and fishing. Lake Kenosia, a pleasure resort, is two miles west of the city. Locally, Danbury is called *The Hat City*. It became known for hat-making in 1780, and in this industry in 1914 it ranked first among the cities of the United States. Important also are the allied silk manufactories and leather and fur factories for making hat accessories. Thirty-six factories altogether are engaged in this business. Automobile parts, electric novelties, machinery and boxes of all kinds are among the other manufactures of the city. Besides the public schools, there are business colleges, a library with 22,000 volumes (in 1916) and the State Normal School. The Federal building was completed in 1916 at a cost of $120,000; the courthouse, state armory and county jail are structures worthy of note.

The first settlement was made in 1684, under the Indian name of *Pahquioque*. It was organized as a town in 1687, was incorporated as a borough in 1822 and received its city charter in 1889. D.D.L.

DANCING, *dan'sing,* a form of exercise and recreation, accompanied by music, which, in its highest form, is an expression of the sense of rhythm and the delight in graceful movements that are common to human nature. Dancing as it is known to-day has developed from a primitive human instinct, the desire to show emotion by means of action, represented by the war dance of the savage or the dance of rejoicing on the return of the tribe from a successful hunt; but by civilized peoples of modern times it has been enjoyed chiefly as an agreeable pastime or an artistic feature of a public entertainment.

The grace and rhythm of the dance are paralleled in nature in the rise and fall of the [illegible]es upon the shore, the rippling of the [illegible]k, the play of light and shadow, or the [illegible]ng of the flowers in the wind. These natforms of rhythm are an especial delight to the poets. In *The Brook,* Tennyson sings:

> I slip, I slide, I gloom, I glance,
> Among my skimming swallows;
> I make the netted sunbeam dance
> Against my sandy shallows.

Wordsworth, charmed by the sight of a field of golden daffodils, joyfully exclaims:

> Ten thousand saw I at a glance,
> Tossing their heads in sprightly dance.

Examples of the poetic expression of the rhythm in nature might be multiplied indefinitely.

Modern Dances. The dances that have enjoyed popularity since the beginning of the modern period had their origin in the general awakening of the arts in the fifteenth century (see RENAISSANCE).

Catharine de' Medici (1519-1589) made dancing fashionable in France, and her countrymen have always excelled in this artistic form of

recreation. The dance which they brought to the highest degree of perfection was the *minuet,* which, founded on an old rustic dance, was introduced into Paris in 1650, finding its way into England three years later. This fairest flower of court dances, with its graceful and stately movements, low salutations and polite curtsies, was a favorite society dance in America in colonial times, where it harmonized most beautifully with the quaint and charming costumes worn by the ladies and gentlemen of the period.

Of the later modern dances, none other has probably had quite the popularity of the *waltz,* which was introduced into European circles about 1795. It is danced in triple time, with smooth, gliding steps which have a backward and forward direction. The waltz is one of the most graceful ballroom dances, and some of the most exquisite dance music ever composed, notably that of Johann and Richard Strauss, is written in waltz time.

The *two-step,* which came into vogue about 1890, is a rival of the waltz in popularity. This is a more spirited dance than the waltz and is based on one that was known in Hungary centuries ago, but in its modern form it is of American origin. Two-step music is distinctly exhilarating, and is brilliantly represented by the bright and tuneful marches of John Philip Sousa.

The *quadrille,* a square dance of French origin, whose modern development dates from 1815; the *lanciers,* an adaptation of the quadrille, developed about 1836; the *polka,* first danced about 1835; and the *schottische,* a modification of the polka, all had their period of popularity and decline. Occasionally one sees the old-fashioned square dances enjoyed at informal parties, and the old English country dance survives in the *Virginia reel,* known in the country of its origin as the *Sir Roger de Coverley.* In this dance the couples face each other in two long rows. A charming description of the Sir Roger de Coverley may be found in Dickens' *Christmas Carol,* in the story of the Fezziwigs' Christmas ball.

The Sensational "New" Dances. In 1911 a curiously-named and not altogether refined dance called the *turkey-trot* made its appearance in San Francisco. Modifications of it soon followed—the *bunny hug,* the *grizzly bear,* the *Texas Tommy,* and others—and Europe and America went dance-mad. A great many people objected to these dances on moral grounds. The dances just named were soon replaced by others more refined in character, which were admitted, after some opposition, into standard dancing schools and adopted generally by the dancing public. Most important of these were the *tango, one-step* and *fox-trot,* all based on walking steps, and the *hesitation* and *waltz canter,* modifications of the regular waltz. A peculiar feature of this craze was the dancing in public restaurants by the patrons of these establishments.

On the vaudeville stage the old-time polka and schottische were revived and were received with great favor. All through the period just described interest in stage dancing maintained a high level, and many public dancers of genuine artistic ability made their appearance. Of these, the Russian dancer Pavlowa attained unrivaled perfection in the art. Others who attained distinction were Isadora Duncan, Ruth St. Denis, and Adeline Genee.

Primitive and National Dances. In its earliest forms among primitive races, dancing was a mode of expressing strong emotions of joy, sorrow and triumph, or solemn religious feeling. The North American Indians, in their ferocious war dances, worked themselves up to a state of mental intoxication capable of carrying them irresistibly on to victory. Magic enters largely into the dancing of all savage peoples, illustrated by the buffalo dances of the Mandan Indians, the object of which was to bring game in a time of scarcity of food; or the mystic dances of the Central African rain doctors, practiced during a season of drought. National or folk dances are those which are characteristic of the people of particular countries, such as the *fandango* and *bolero* of Spain, the *tarantella* of Italy, the *mazurka* and the *polonaise* of Poland, the *reel* and *Highland fling* of Scotland, and the *jig* of Ireland and Wales. B.M.W.

DAN'DELION, a plant found throughout the world, sometimes cultivated for use as a vegetable or a medicine, but nearly always growing wild in lawns and meadows and regarded as a troublesome weed. Lowell thus describes it:

Dear common flower that growest beside the way
Fringing the dusty road with harmless gold.

The name comes from French words meaning *tooth of a lion,* and was suggested by the smooth, coarsely-toothed leaves. The flower head is a lovely golden yellow, which changes later to a cotton-like, white "blowball" of feathered seeds which sail far and wide on the winds, and so are well distributed (see SEEDS, subtitle *Seed Dispersal*). The flower stem is

smooth, erect and hollow, and the entire plant contains a white, milky juice.

Young dandelion leaves are often used for greens and salads. If blanched like celery, they will become more tender and less bitter. The thick, fleshy taproot, sometimes twenty inches long, when carefully washed and thoroughly dried is used for its medicinal properties in diseases of the liver and in dyspepsia. Over 200,000 pounds of dandelion root, commanding from four to six cents a pound, are imported into the United States each year.

ROOT OF DANDELION
The length of the root is from ten to twenty times the height of the plant above the ground.

DAN'DRUFF, a white, scaly substance that forms on the scalp as the result of a skin that is too dry, or because of certain scalp diseases. When the head is scratched large quantities of minute scales are loosened from the skin and cling to the hair or fall on the clothing. Dandruff may be simply scales of skin, but in the disease known as *seborrhoea* oily matter secreted by the glands dries and forms scales which are also classed as dandruff. Any scaly formation results in a gradual loss of the hair, and dandruff is a very important cause of baldness. Vigorous massaging of the scalp daily, to stimulate the circulation, and frequent shampooing with pure soap are helpful remedies, but stubborn cases should have the attention of a specialist.

DANIEL, *dan'yel,* a Hebrew prophet, the hero of the Old Testament book which bears his name. No other Biblical hero is more popular, for his wonderful rise from the position of captive and slave in a royal household to that of ruler of the kingdom was brought about not through kingly favor but through Daniel's own wisdom and goodness. When Nebuchadnezzar, king of Babylon, swept down upon Jerusalem, he carried off not only the sacred vessels from the temple but a number of high-born youths, of whom Daniel was one. In Babylon, Daniel refused to eat of his "portion of the king's meat," lest he might defile himself, but throve so well on his simple diet that he attracted the notice of the king.

One night King Nebuchadnezzar had a troublesome dream which his wise men could not interpret. But Daniel, declaring that "there is a God in heaven that revealeth secrets," described the dream and gave the interpretation, and as a reward was made ruler over the whole province of Babylon. In later years he made clear another royal dream, which foretold the madness of Nebuchadnezzar, and interpreted to Belshazzar, the son of Nebuchadnezzar, the marvelous handwriting on the wall (see BELSHAZZAR). Under Darius, the Median, who fulfilled the writing by capturing Babylon, Daniel was given high authority by reason of his wisdom, but the Babylonian princes became jealous and by a trick had him cast into a den of lions. His miraculous preservation led Darius to acknowledge the God of the Hebrews and put an end to the persecutions of Daniel, who from this time on "prospered in the reign of Darius, and in the reign of Cyrus the Persian."

DANISH WEST INDIES. See WEST INDIES, DANISH.

DANTE ALIGHIERI, *dahn'ta ah le gya're,* (1265-1321), one of the world's great poets, the chief pride and ornament of Italian literature. As Homer's name is associated with the *Iliad,* Vergil's with the *Aeneid* and Milton's with *Paradise Lost,* so that of Dante, the fourth great epic poet, calls instantly to mind the *Divine Comedy*—that marvelous account of the wanderings of a poet soul in hell and purgatory. No less intimately connected with the name of Dante is that of Beatrice, the idol of his life from his childhood and the inspiration of his poetry, although he never saw her more than a few times and she had very little knowledge of him. He tells in his *New Life* of his meeting with her when he was but nine years of age, and traces the course of his love. This was an idealized emotion, far removed from desire for possession and from jealousy, for he loved her just as devotedly and with no hint of bitterness after her marriage to another (see BEATRICE PORTINARI).

Dante was born in Florence, of a family which probably belonged to the lower nobility, and though little is known of his youth and education it seems certain that he was associated with the poets and learned men of his time. In 1292, when he had recovered from the grief into which the death of Beatrice plunged him, he married Gemma Donati, who bore him two sons and two daughters. Shortly after his marriage he entered political life, and in the Florence of those days this promised anything but a peaceful life. The Guelphs (see GUELPHS AND GHIBELLINES), shortly afterward

DESTROYED FOR GUN METAL

This imposing bronze statue of Dante, at Trent, Austria, was demolished in 1916 to furnish material for the manufacture of cannon.

split up into two rival factions known as the Whites and the Blacks, and Dante allied himself with the former, the more moderate branch. The Blacks, or Papal party, coming to power in 1302, the leaders of the Whites were banished, and with them, Dante. For the rest of his life he was an exile, and his history during that time is semi-mythical. He visited several cities, but certainly not all that have since put forward claims to that honor, and in September, 1321, died at Ravenna, where he was buried.

His Great Work. Dante wrote other things—*The New Life*, mentioned above, *The Banquet* and a treatise *On Monarchy*—but his fame rests on the *Divine Comedy*. This he called *Comedy*, in accordance with the custom of the time, because it ends cheerfully, and appreciative readers added the epithet *Divine*. In large part, at least, it was written during his exile, and shows the firm grasp and keen insight of a mature man. It represents the poet as traveling through hell and purgatory under the guidance of Vergil, and through paradise with the radiant, glorified Beatrice as his guide. In hell, over the gate of which appear the words, "All hope abandon, ye who enter here," he sees the hosts of guilty souls, whose sin and punishment he pictures in few words but with passionate force; in purgatory there are like scenes, but the gloom is not so deep, as the punishments are merely temporary.

With entrance into the earthly paradise all that is sordid and evil disappears, and the poet moves with Beatrice through beautiful flowers, soft breezes and sweet sounds. Finally he emerges into the celestial paradise, where he feels himself in the presence of God, but cannot see Him because of the excess of light. So, in a burst of triumph, ends this greatest poem which the Middle Ages produced. It has been translated into many languages, Longfellow having made an excellent poetical translation into English, and an enormous number of books have been written about it. Interest in it bids fair to remain unflagging as long as men love great poetry. A.MC C.

Consult Fletcher's *Dante Alighieri*, in "Home Library" Series; Toynbee's *Dante in English Literature*.

DANTON, *dahN toN'*, GEORGES JACQUES (1759-1794), a French Revolutionary leader, born at Arcis-sur-Aube. In 1780 he went to Paris and attached himself to Mirabeau, and after the latter's death, to Robespierre and Marat. It was he who uttered the fierce words, "To the kings, we will fling down the head of a king as the gage of battle," meaning that Louis should be beheaded. Danton was known among the Revolutionary leaders as terrible and fearless, but later he would have joined those who were striving for a republic, in order to check further bloodshed. The Girondists, however, would not join with him and he was forced to stay with the Jacobins, which party had organized the Reign of Terror, but the most cruel among this party finally gained the upper hand and Danton was guillotined.

Related Subjects. The reader is referred to the following articles in these volumes:

French Revolution
Girondists
Jacobins
Marat, Jean Paul
Robespierre, Maximilien Marie Isidore

DANUBE, *dan'ube,* the most important water route in Europe and second only to the Volga, among the rivers of that continent, in length and drainage area. The Danube has its origin in the junction of two small mountain streams of the Black Forest, in Germany, which unite at a point 2,187 feet above sea level. It follows a general easterly course and winds and curves for 1,750 miles before it reaches its outlet, the Black Sea. Its drainage basin, 315,000 square miles in extent, almost one-tenth of the total area of the continent of Europe, includes Southern Germany, Bosnia, Serbia, Bulgaria and Rumania. The city walls of Ulm, Ratisbon, Passau, Vienna, Budapest and Belgrade are washed by the waters of this great waterway. It was the center of Roman colonization and the scene of inroads of Huns, Magyars and Avars, and the highway which brought the Turk westward and down which he was finally driven in his easterly flight. The source and course of the river are shown on the accompanying map. See, also, map of EUROPE, for elevations.

COURSE OF THE DANUBE

Commercial Importance. The Danube is the chief natural route for the commerce of Central Europe, and its value as a commercial highway has been greatly enhanced by extensive improvements made from time to time. At least $10,000,000 has been appropriated for making the Iron Gate navigable; commerce through this gap is regulated by an international commission, with headquarters at Galatz. Communication with the Rhine has been established by the construction of the Ludwig Canal in Bavaria, and the Sulina channel mouth, at the delta, has been deepened so as to permit the entrance of large ocean-going vessels. The annual tonnage through this mouth in times of peace is 2,000,000.

The Iron Gate, mentioned above, is a mountain pass between Orsova, Hungary, and Glan Serbia. J.R.

DAN'VERS, MASS., a residential and manufacturing city of Essex County, four miles northwest of Salem and nineteen miles northwest of Boston. It includes the villages of Danvers Center and Danvers Port, and has an area of nearly twelve square miles. It is on a small river of the same name, navigable to the Atlantic Ocean, a short distance east, and is served by the eastern and western divisions of the Boston & Maine Railroad and by interurban lines. The population in 1910 was 9,407; as reported by the Federal census of 1916 it was 9,949.

Danvers is an attractive New England town with wide, well-paved streets, shaded by splendid old trees. It is the home of Saint John's Preparatory College (Roman Catholic), the Essex County Agricultural College, Peabody Institute Library and the Danvers Historical Society. The state insane asylum, situated here, has a plant erected at a cost of nearly $2,000,000. Danvers Park is nearly one square mile in extent. The principal industries include the manufacture of leather, shoes, electric lamps and bricks.

Danvers was once part of Salem. In 1752 it was incorporated as a separate town, and in 1855 was divided into South Danvers (afterwards Peabody) and Danvers. In that part of the town keeping the original name, witchcraft first occurred in 1692, and of the number of citizens of the district who were arrested ten were convicted and hanged (see WITCHCRAFT). The many places of historical interest in Danvers include the birthplace of Israel Putnam, the Revolutionary soldier; Mount Burnett, a place frequented by Hawthorne, and Oak Knoll, the home of Whittier. The government is administered by town meetings. A.E.F.

DANVILLE, ILL., is the county seat of Vermilion County, in the east-central part of the state, five and one-half miles from the Indiana state line, 123 miles south of Chicago and thirty miles east of Champaign. It is on the Vermilion River and on the Chicago & Eastern Illinois (whose railway shops are here); the Cleveland, Cincinnati, Chicago & Saint Louis; the Wabash, and the Chicago, Indiana & Southern railroads, and on the Illinois Traction electric line. The population in 1910 was 27,871; in 1916 it was 32,261, by Federal estimate.

The city has the Danville Branch National Soldiers' Home, a Federal building erected in 1910 at a cost of $300,000, a courthouse costing $185,000, a Y. M. C. A. building, Masonic Temple, Carnegie Library and two public hos-

pitals. The parked area exceeds 100 acres and comprises Lincoln, Ellsworth, Cannon, Douglas and Garfield parks.

Danville is in a soft-coal district and coal mining is among the important industries, which also include founding and the manufacture of zinc, hardware, carriages, glass and clay products.

The town was settled in 1830, incorporated in 1839 and became a city in 1867. Four suburbs have been annexed, Vermilion Heights in 1905, South Danville in 1906, Germantown and Roselawn in 1907. The city is the home of Joseph G. Cannon, for many years notable in the public life of the nation. P.L.W.

DANVILLE, VA., an important industrial center of Pittsylvania County, centrally located on the southern state boundary line, 141 miles southwest of Richmond. It is on the Danville River and on the Danville & Western and the Southern railroads. In 1910 the population was 19,020; in 1916 it was 20,021. The area exceeds three square miles.

Danville is in the fertile Piedmont section, situated on heights which command fine views of the country round about. Tobacco, grain, fruits and other produce are extensively grown in the surrounding region, and the city has an important trade in loose-leaf tobacco and manufactured products. Abundant power is supplied by the river for its industrial plants, which include tobacco factories, a cheroot factory, flour mills, knitting mills, elevator works and manufactories of cotton goods, furniture, trousers and overalls. There are large tobacco warehouses, and the city has important wholesale interests, supplying a wide territory in Virginia and North Carolina.

The city is the seat of Roanoke Institute (Baptist), Randolph Mason Institute (Methodist Episcopal) and Danville School for Boys, and contains a city hall, public library, Masonic Temple, a hospital, an orphanage and several parks. It was incorporated as a town in 1792 and chartered as a city in 1833. The records of the Confederacy were removed to the city after the fall of Richmond in 1865, and it was for a time the Confederate capital. H.B.W.

DANZIG, *dahn'tsik,* one of the most important ports and commercial centers of Germany, situated on the left bank of the Vistula River, four miles from the Baltic Sea and 253 miles northeast of Berlin. The city retains much of its picturesque medieval aspect, for it is over 700 years old; it contains, however, many beautiful modern buildings. It is noted for its brandy, beer and other liquors; it has for many years been a center of manufacture of arms and munitions of war; this important industry gives employment to many thousands of men. Ships of the largest size are built in the imperial shipbuilding yards and those of private concerns. The trade of the city was increased by the opening, in 1899, of the harbor at Neufahrwasser, at the mouth of the Vistula. Steel mills, distilleries, flour mills and sugar refineries have recently been established and these establishments were being rapidly developed before the beginning of the War of the Nations in 1914. Danzig fell to the possession of Prussia in the partition of Poland in 1793; it was taken by the French in 1807 but was restored to Prussia in 1814. Population in 1910, 170,337.

DAPHNE, *daf'ne,* in classic myths, a beautiful nymph who delighted in woodland sports and hunting, the daughter of the river-god Peneus. She desired to remain unmarried, like Diana, but her beauty brought many lovers. Apollo, especially, pierced by a golden arrow from Cupid's bow, was filled with love for her. But Daphne, pierced by Cupid's leaden arrow, abhorred the thought of loving. One day Apollo chased Daphne through the woods, and when her strength failed she called on her father to change her form. Immediately she was changed into a laurel tree, and ever after the laurel was sacred to Apollo. He wore a wreath of its leaves as a crown and since then laurel wreaths have been symbols of honor and merit. See LAUREL.

APOLLO AND DAPHNE
Statue by Bernini, in the Villa Borghese, Rome.

DAPHNIA, *daf'ne ah,* or **WATER FLEA,** a very tiny fresh-water shellfish (crustacean), which moves through water in skips and jumps, like a flea, using its feathery feelers (anten-

nae) as oars. The body of this microscopic animal is encased in a dainty, transparent, hinged shell. The head is prolonged into a snout and is provided with feelers and a single, central, compound black eye. There are five pairs of appendages, which move continually, aiding the animal's breathing. Some water fleas turn red in summer, and, swarming in millions in ponds and marshes, impart their color to the water.

DARDANELLES, *dahr da nels'*, a strait connecting the Aegean Sea with the Sea of Marmora, which in turn, at its eastern extremity, is connected by the Bosporus (literally, *ox-ford*) with the Black Sea. The two straits,

THE DARDANELLES
The small black areas mark the extent of the advance of the entente nations in the disastrous Gallipoli campaign.

together with the Sea of Marmora, form a waterway leading from the land-locked Black Sea to the Mediterranean Sea. The European nations have long recognized the fact that any one nation which controlled both of the straits and the Black Sea could build and assemble a war fleet in the Black Sea which would be practically safe from attack and yet have all the maritime nations of Europe at its mercy.

The Dardanelles is a narrow channel, easily defended, and is recognized as the keystone which hitherto has held together the Turkish Empire. Should it ever fall into the possession of another nation, the dominion of Turkey in Europe must come to an end. The power which holds the straits inevitably holds Constantinople, and if ever the Turks withdraw from Constantinople Turkey will become a minor Asiatic power. The importance of the Dardanelles has frequently been proved in the history of Turkey, but never more clearly than in 1915, during the War of the Nations. For almost a year the allied armies and fleets attempted to force a passage to Constantinople, only to retire at last, either because the cost in men and money proved too terrible, or because, as the Turks have claimed for years, the Dardanelles was impregnable. The accompanying map shows the very slight foothold gained by the allies, at tremendous cost.

At its narrowest point the Dardanelles is only one mile wide from the European to the Asiatic shore. Its average width is three to four miles, and it is about forty-seven miles long. The channel has an average depth of less than 200 feet. Except when the wind is blowing eastward across the Aegean Sea, the Dardanelles has a strong outward current, but a powerful undercurrent flows in the opposite direction, and is constantly carrying a supply of salty water through the Dardanelles, the Sea of Marmora and the Bosporus into the Black Sea. It is this undercurrent which keeps the Black Sea from gradually becoming a fresh-water body.

In Myth and Story. To the ancient Greeks the channel was known as the *Hellespont*, that is, Sea of Helle, in honor of Helle, daughter of Athamas, a king in Boeotia, and the goddess Nephele, or Cloud. Athamas later married Ino, a mortal, who planned to sacrifice Phryxus, brother of Helle, to the gods. Nephele saved her children by giving them the ram with the golden fleece, but as they were crossing the strait between Europe and Asia, Helle fell from the ram and was drowned. The fleece of this ram was afterwards sought by Jason and the Argonauts (which see).

Another famous legend is that of Hero and Leander. Near Abydos, where the strait is about 6,500 feet wide, Leander is said to have swum across each night to see Hero, and in modern times the poet Byron, in emulation, accomplished the same feat in one hour and ten minutes. See HERO.

Just when the name *Dardanelles* began to take the place of *Hellespont* is uncertain. The word is derived from the ancient Greek city of Dardanus, on the Asiatic side of the strait. The city, according to legend, was built by a hero of the same name, a son of Zeus and Electra. This hero became the founder of the race of Dardani, and was the ancestor of Aeneas.

In History. Almost from the dawn of history, the Dardanelles has been of strategic importance, and has constantly figured in wars and in peaceful negotiations. Near Abydos, later the scene of Leander's and Byron's exploits, Xerxes crossed into Europe with a great army in 480 B.C., and here, too, Alexander led his forces across a great bridge of boats in 334 B.C. Centuries later the strait, or more

properly, Constantinople, became the heart of the Byzantine Empire, and it was not until the Turks were in absolute command of the Dardanelles that the empire was doomed.

After the fall of the empire in 1453, the Turks remained absolute masters of the Dardanelles. In 1807 a British fleet forced its way through to Constantinople, which up to that time had never seen a hostile fleet. In 1841 the five great powers of Europe—Great Britain, France, Russia, Prussia and Austria—agreed with Turkey that no foreign man-of-war should pass the Dardanelles without Turkey's special permission. This agreement was renewed in 1856, after the Crimean War, and again in 1871 and in 1878.

For many years it was Russia's announced intention to secure a change in this policy, and if possible to secure for itself the control of the strait, that it might have access to the sea from ports that were never frozen. Great Britain was once the leader of the opposition to Russian expansion, but after the beginning of the War of the Nations announced its future sympathy with this Russian ambition. J.R.

DAR'FUR, the most westerly state of the Anglo-Egyptian Sudan, in East Central Africa. It covers an area of 150,000 square miles and consists chiefly of a vast plateau nearly 3,000 feet above sea level. The inhabitants are negroes and Arabs whose chief occupations are agriculture and raising cattle. Ostriches are also bred, and their feathers are an important item of commerce. The climate is fairly healthful, except in the rainy season, which lasts from June to September. There are no rivers, but instead there are many small water courses, which are filled with raging torrents during the rains. Copper, iron and salt are produced, and the mineral wealth of the country is very great. The capital is El Fasher, a town with a few buildings in European styles but consisting principally of straw-covered huts. The country is ruled by a sultan under British guidance, and it pays a yearly tribute of $2,500 to the Anglo-Egyptian government. Population, about 1,000,000.

DARIEN, *da ri en'*, the name given to a gulf and isthmus geographically located between the continents of North and South America. The isthmus, however, is no longer known by that name, but is now called the Isthmus of Panama. The isthmus was reached by Columbus on his fourth voyage, in 1502, and was an early field for Spanish exploration and settlement. It was crossed in 1513 by Balboa, governor of the Darien settlement, who from its highest point discovered the Pacific Ocean. The first settlement was that of Santa Maria del Antigua, situated on the small Darien River, northwest of the Atrato. The gulf of the same name is a portion of the Caribbean Sea, between the republics of Colombia and Panama, its southern extension being called the Gulf of Uraba.

Darien Scheme, a gigantic project launched in 1695 by William Paterson, a Scotchman and first projector of the Bank of England, to establish a colony and commercial center on the Darien isthmus near Panama, in order to gain trade for Scotland. European manufactures were to be sent to the Gulf of Darien and conveyed by land across the isthmus, where the products of South America and Asia were to be exchanged. Nearly $4,000,000 was subscribed, although a considerable portion of it was never paid in, and in 1698 five vessels laden with merchandise and provisions, with 1,200 persons, sailed from Leith, the Scottish port, for New Caledonia, the name given to the new Darien settlement. The climate proved unhealthful, the Spaniards attacked the defenseless colony, the English colonies of America disapproved, and after a period of eight months the colonists were compelled by disease, famine and persecution to return to Europe. Paterson lost his reason for a time, but later recovered. In 1706 the lords commissioners for England purchased the shares of private individuals of the Darien Company, to bring about a better understanding between Scotland and England.

DARIUS, *da ri'us,* the name of the three greatest monarchs in the long history of Persia. Only two of them, however, are of present-day interest.

Darius I (558-485 B.C.) was one of the most notable rulers the East has ever produced, for he was distinguished as a statesman, as a warrior and as an organizer. The record of his achievements, which he had carved in cuneiform writing on a lofty cliff known as the Behistun Rock, in Western Persia, states that in the year 521 B.C. he slew Gautama, who had usurped the Persian throne on the death of Cambyses, and made himself ruler of Western Asia and Egypt (see CUNEIFORM INSCRIPTIONS). After putting down revolts in various parts of his empire, he devoted himself to the arts of peace. The Persian realm was divided into *satrapies,* or provinces, with a governor over each; a magnificent system of post roads was built, and a national coinage was provided.

laid out, has many fine residences, and has excellent facilities for boating and bathing. It also has manufacturing industries of importance; chief among its products are refined sugar, lumber, chocolate, spice, corn meal, beer, soap and bolts. Dartmouth was founded in 1749, the same year as Halifax. Population in 1911, 5,058; in 1916, about 5,500.

DARTMOUTH COLLEGE, at Hanover, N. H., one of the oldest American colleges, is the outgrowth of a charity school for poor Indians. The Indian school was established in 1754 at Lebanon, Conn., but in 1770 was removed to Hanover. Meanwhile, its friends had raised an endowment fund, and it had been decided to admit whites as well as Indians. The endowment fund was placed in the hands of a board of trustees, of which William, the second Earl of Dartmouth, was chairman. A large tract of land in New Hampshire was given to the school, and in 1769 King George III signed a charter for Dartmouth College, named in honor of its chief patron. The college began existence in log huts in the midst of a wilderness, and the first permanent building, Dartmouth Hall, was not completed until 1791. The Revolutionary War put an end to most of the support from England, but gradually the attendance and endowment were increased.

The college now confers degrees in arts, letters, science, civil engineering and medicine, has 120 instructors and almost 1,500 students. The medical school dates from 1798 and the Thayer School of Engineering from 1867. The Amos Tuck School of Administration and Finance, founded in 1900, was the first commercial school in the United States to accept only college graduates as regular students. An endowment fund of $4,000,000 and an annual tuition fee of $140 for each student provides most of the college revenue.

Many distinguished men are numbered among the graduates of Dartmouth, including three eminent statesmen—Daniel Webster, Thaddeus Stevens and Salmon P. Chase.

Dartmouth College Case, one of the most important cases ever decided by the Supreme Court of the United States. The court held that a charter granted by a state was a contract, and that any attempt by the state to alter it was unconstitutional, because "no state shall . . . pass any . . . law impairing the obligation of contracts" (Constitution of the United States, Art. I, Sec. 10). The case arose from a religious and political struggle for the control of the college. The state legislature had amended the charter by adding eleven new trustees to outvote the old members of the board, but the latter, with Daniel Webster for attorney, carried the case to the Supreme Court. The decision was handed down by Chief Justice Marshall in 1819.

DAR'WIN, CHARLES ROBERT (1809-1882), a distinguished English naturalist, whose epoch-making work, *The Origin of Species by Means of Natural Selection*, published in 1859, laid the foundation for the development of the theory of evolution (which see). His career shows the power of hereditary influence, for his grandfather, Erasmus Darwin, was a naturalist of some distinction, and his father, Robert Waring Darwin, was a fellow of the Royal Society. Charles Robert was educated at the University of Edinburgh, and at Christ College, Cambridge, graduating in 1831.

CHARLES DARWIN

His father had hoped to see his son become a clergyman, but the young man's liking for natural history overshadowed other interests, and not long after his graduation he eagerly accepted an offer to sail with the British surveying expedition on the steamship *Beagle*, in the capacity of naturalist. The expedition made a five-years' tour of the world (1831-1836), affording Darwin an extraordinary opportunity for original research and study of plant and animal life, and giving him the basic ideas upon which he built his theories of evolution.

On his return to England he began the preparation of a series of important scientific works, culminating in 1859 in his *Origin of Species*. Up to this time it had been generally believed that each kind of animal was descended from a like species, that dogs had always been dogs, and tigers had always been tigers, and that the division of the animal kingdom into species was due to special acts of creation. But Darwin's explanation of the origin of species was based on the law of natural selection, or the survival of the fittest. That is, in the plant and animal world, vast numbers of individuals are produced, but in the struggle for existence

only the strongest, or "fittest," survive. The special qualities are inherited which make these individuals superior to those that perish; the next generation starts from a higher plane, and so on through successive generations. A continuation of this unconscious selecting process accounts for the peculiarities of the existing species; the result of the selective process he called "perfect adaptation." This adaptation theory is of fundamental importance in the scheme of evolution.

In 1871 Darwin gave to the world a second epoch-making book, *The Descent of Man,* in which he extended his theory to include the human race. Though at the time he brought upon himself the severe criticism of those who interpreted as actual fact the Bible story of the Creation, yet since his death the underlying principles of evolution as applied to man have come to be generally accepted.

The later years of the great naturalist were devoted to the elaboration of his theories, and though he labored under the worst of handicaps—continual ill-health—his perseverance and industry bore fruit in a remarkable list of publications. These include *Fertilization of Orchids, Expression of the Emotions in Man and Animals, Different forms of Flowers in Plants of the Same Species* and *The Power of Movement in Plants.* He was buried in Westminster Abbey. B.M.W.

Consult Thomson's *Darwinism and Human Life;* Francis Darwin's *The Foundations of the Origin of Species.*

DAS'KAM, JOSEPHINE DODGE. See BACON, JOSEPHINE DODGE DASKAM.

DATE AND THE DATE PALM. In the hot, dry lands of deserts and caravans, and in the land of pyramids and mummies grows that stately tree which so constantly appears in poetry and proverbs of the East, the *date palm,* the palm tree of Scripture. On that tree, at a distance of fifty, sixty or even a hundred feet from the ground, grow golden bunches of a fruit which for as many as four thousand years has been one of the principal articles of food for the brown-skinned peoples of the lands of Northern Africa and Southwestern Asia. The tree is also cultivated in China, and in France and Italy.

Next to the cocoanut palm, the date palm is without doubt the most interesting and useful of the palm family. The tall, straight stem, nearly the same thickness throughout its length, grows from its summit a magnificent crown of large, feather-shaped leaves which have been used in religious services of pagans, Jews and Christians from earliest times. There, too, appear the inconspicuous flowers, male and female on separate trees. Later, if fertilization has been secured by placing a bunch of pollen-bearing blossoms in the tree with the female flowers, the flower stalks bear twenty- to twenty-

IN A NORTH AFRICAN ORCHARD

five-pound bunches of from 180 to 200 dates.

These palms begin to bear from six to ten years after planting, and produce each from 100 to 600 pounds of fruit a year, bearing for a century or more. Date palms require a very hot, dry climate having an average temperature of 90° F. for three months of the year. A sandy, alkaline soil is satisfactory. Plenty of water must always reach the roots, so irrigation and artesian wells are made use of, for the fruit will not ripen unless the summer season is rainless. In Algiers there is an oasis where the trees are grown in deep pits dug in the soil, so the roots may reach the moisture far below the surface.

The Fruit. Although it is a light golden color when on the tree, most people know the date in its dried form as an oblong, fleshy, sweet fruit about two inches long, deep russet in color, containing a hard, oval seed with one deep furrow. Dates are eaten either fresh or dried. Cakes of them pounded and kneaded together are the food of the Arabs who traverse the deserts.

As the food value of dates is high, their nutritive qualities being equal to those of wheat and corn flour, efforts have been made to cultivate date palms in the United States. The area devoted to commercial date culture is limited to such regions as the Salton Basin and hot interior valleys of Central California; the valley of the Colorado River to the Nevada boundary; the lower Salt and Gila river valleys in Arizona, and a small portion of the lower

Rio Grande Valley in Texas. Up to 1917 over 4,500 trees in bearing in Arizona, California, Texas and Florida have produced about 10,000 pounds of fruit yearly, valued at a little over $500. But over 22,000 trees not of bearing age were at that time reported, almost 20,000 of them being in California, so the date industry in the United States may still develop into one of importance.

HOW DATES ARE GATHERED

Uses. Besides the food value of the fruit, there are a number of other economic values credited to the date palm. A liquor resembling wine is made from dates by fermentation. The trunk of the tree and other parts are used for fuel and in the construction of fences, etc. The leaves are used for matting, baskets and bags; the fiber, in making rope. The buds are eaten as a vegetable. When roasted, the fruit stones are used as a substitute for coffee, and when ground they yield an oil. When the oil has been extracted the remaining substance is valued as food for cattle.

M.S.

For information relating to the growing of dates in America, consult bulletins issued by the secretary of state of Arizona.

DAUDET, *do deh'*, ALPHONSE (1840-1897), a French author and dramatist, famous because of his keenness of observation and ability to write what he saw. In his younger days he was deprived of the pleasures most boys enjoy, and at the death of his father he went to the college of Alais, a little town of the Cevennes, where he worked and studied, later becoming a tutor. He was unhappy in this, and in 1857 he abandoned teaching and took refuge with his brother Ernest, who was earning $15 monthly by writing for newspapers in Paris. This sum supported the brothers until the dawn of brighter days.

When he was eighteen Alphonse published *Les Amoureuses,* a small volume of poems which gave him some recognition in the literary world and soon led to appointment as private secretary to De Morny, half brother of Napoleon III. About this period he dramatized *Numa Roumestan* and wrote several plays. In 1868 he issued *La Petit Chose (The Little Chap),* an autobiographic novel. His best and most enduring novels were written during the following fourteen years, and include *Jack, The Nabob, L'Evangeliste, Tartarin of the Alps* and *Sapho.* The latter, the best known of his works and probably the one of lowest moral tone, yet teaching a striking lesson, he considered his masterpiece. *Sapho* has become known through its dramatization to thousands of people who never read one of Daudet's books. Throughout his literary career he was given help and inspiration by his wife, whom he married in 1867.

ALPHONSE DAUDET

DAUGHTERS OF THE AMERICAN REVOLUTION, a society organized in Washington, D. C., October 11, 1890, for the purpose of perpetuating reverence for the forefathers' deeds in Revolutionary history, the erection of monuments and the collection of relics. Any woman is eligible for membership at the age of eighteen, provided she is acceptable to the society and is a lineal descendant of an an-

Building erected and owned by the Daughters of the American Revolution, in Washington, D. C. It is called Continental Hall.

cestor "who, with unfailing loyalty, rendered material aid to the cause of independence as a recognized patriot, soldier or sailor, or as a civil officer in one of the several colonies or states." Besides headquarters in the national capital, where the society owns a beautiful memorial hall completed in 1910, there are chapters in nearly every state in the Union, under direction of a state regent, with local chapters in every city. The chief officer of the society is the president-general.

DAUPHIN, *daw'fin,* the official title of the eldest son of the king of France before the Revolution of 1830. The name, which means *dolphin,* belonged originally to the lords who ruled the province of Dauphine, and was adopted as their title because of the three dolphins worn on their helmets. The last lord, who had no children, ceded his province to Charles of Valois, the grandson of the French king, with the provision that the heir to the French throne should always be called the Dauphin of Vienne and should rule the province. At first the dauphin had many privileges as ruler of the province of Dauphine, but later when it was put under the same rule as all other provinces, the title became merely honorary.

DAUPHIN, a town in Manitoba, on the Vermilion River and the Canadian Northern Railway, 178 miles northwest of Winnipeg. From a population of 1,134 in 1901 it grew to 2,815 in 1911 and the census of 1916 gives an increased population of 3,200. This increase is largely due to the construction of the Canadian Northern Railway, which made possible the development of a rich grain-growing region. The storage and shipment of grains and the manufacture of flour are Dauphin's chief industries, but mention should also be made of machine works, a creamery, sash and door factory, saw mill and mineral water factory. Good fishing is to be had in the neighborhood in Lake Dauphin and Lake Winnipegosis, and there is some big game in the Riding Mountain Reserve, to the south.

DAVENPORT, *dav'enport,* Iowa, a progressive manufacturing city and the county seat of Scott County. Davenport ranks third in the state in population, following Des Moines and Sioux City. It is situated in the eastern part of the state, on the Mississippi River. Clinton is thirty-five miles northeast, Cedar Rapids is seventy-four miles northwest and Des Moines, the capital, is 175 miles west. Railway lines entering the city are the Chicago, Rock Island & Pacific; the Chicago, Milwaukee & Saint Paul, and the Chicago, Burlington & Quincy; interurban lines extend north to Clinton and west to Muscatine. Additional transportation facilities are provided by packet lines plying the river between Saint Louis and Saint Paul. In 1835 a company headed by Colonel George Davenport purchased the present site of the city. It was incorporated as a town in 1838, and the city charter was granted in 1851. Its population increased from 43,028 in 1910 to 48,811 in 1916; the foreign element is chiefly German. The area is eight and one-fourth square miles.

Davenport lies on the slope of a steep hill, near the foot of the Upper Rapids of the Mississippi River, and commands a fine view of the river and Rock Island, with which it is connected by a great bridge. This island is owned by the United States government, and here have been erected an arsenal, military headquarters and several costly Federal buildings. Davenport and two cities in Illinois just across the river—Moline and Rock Island—are known as the *Tri-Cities.*

Steel mills at Davenport employ 2,400 men and have an annual output valued at $14,000,000; locomotive works employ 400 men, and the value of their annual output is estimated at $3,000,000. Besides, there are manufactories of food products, agricultural implements, pottery, brooms and buttons. The country around Davenport is an agricultural and coal-mining section, and large quantities of farm produce are shipped from this point. The grain and flour business is important.

The park reservations of Davenport comprise 120 acres, and much attention is given throughout the city to shrubbery and garden effects. In addition to its public and parochial schools, there are Saint Ambrose College, Saint Katherine's Academy for Girls, Immaculate Conception Academy and the Academy of Natural Sciences, with a large scientific library; the public library was provided by Andrew Carnegie and the city. Davenport is the see of a Roman Catholic archbishop and of a Protestant Episcopal bishop. C.C.H.

DA'VID, King of Israel (1041-970 B. C., Biblical chronology). David was a shepherd lad, the youngest son of Jesse, the Bethlehemite. He had seven brothers, all strong, brave men, but David is spoken of as "having a beautiful countenance, and goodly to look upon." The Lord directed the prophet Samuel to go to Bethlehem and pour oil on David's head to

indicate that he was set apart to become king of Israel. Samuel did as he was directed, "and the spirit of the Lord came mightily upon David from that day forward"; but David returned to the care of his flocks, all unconscious of his future responsibilities and greatness.

DAVID
From the statue by Michelangelo, in Florence, Italy.

David and Goliath. David was about sixteen when he was anointed by Samuel. When he was about twenty a war broke out between the Israelites and the Philistines, and David's brothers joined the army of Saul, the king of Israel. One day Jesse told David to take some food and clothing to his brothers. He found the two armies arranged on the opposite sides of a valley, ready for battle. For forty days the armies had held this position, and each day a giant of the Philistines, Goliath by name, came forth into the valley and taunted the Israelites to send a man to fight with him, saying that if the Israelites killed him then the Philistines would be the servants of Saul, but if he killed the Israelite then Saul's army would become servants of the Philistines.

The Israelites were sorely troubled, for no one in all Saul's army dared fight Goliath on those terms. Then David came. He made a few inquiries about this boastful giant who defied the armies of the living God, and volunteered to accept his challenge. Having obtained Saul's consent, he ran into the valley in his simple shepherd's garb, with only his staff and sling for weapons. Goliath was clothed in heavy armor and carried a sword and a spear. David ran to the brook and picked up a few smooth stones for his sling. He was then ready for the conflict. In breathless amazement the two armies looked upon the young shepherd, for, placing a stone in his sling, he hastened to meet his foe. When he reached the proper distance, David stopped and hurled a stone, which struck Goliath in the forehead with such force that even his armor was no protection against it, and he fell to the ground. David then drew the giant's sword and cut off his head and brought it to Saul. The Philistines fled in dismay. David had won a great victory for Israel.

David and Jonathan. Jonathan was Saul's eldest son, and he and David became fast friends. Jonathan loved David as he loved his own soul. David was a sweet singer and a skilful player on the harp. He was a brave soldier as well, and after he killed Goliath he remained with the army. He soon became a commander, and wherever he went he led his forces to victory. He was very popular with the soldiers and with the people, but Saul was of a melancholy disposition and often gave himself up to fits of sadness. On these occasions he frequently sent for David to sing and play upon the harp, to drive away his gloomy spirits. Once when David was returning from a great victory over the Philistines he was given a rousing reception by the people and the women sang—

> Saul hath slain his thousands,
> And David his ten thousands.

This made Saul so angry that he determined to take David's life. From this time until Saul's death David was obliged to live in another country to escape Saul's anger. During all those years Jonathan stood between his father and David, in whose behalf he once risked his life in defending David before the king. Finally, in the Battle of Gilboa, the Israelites were sorely defeated by the Philistines. Jonathan was slain, and Saul was so severely wounded that he took his own life. David said of Jonathan—

> Thy love for me was wonderful,
> Passing the love of women.

David as King. After the death of Saul, David became king of Judah, and had his capital at Hebron. For several years there was war between the forces of David and the forces of Saul, who were now under the leadership of Abner. But the forces of David grew stronger while the forces of Saul became weaker, and after seven years of struggle David became king of all Israel. He established his capital at Jerusalem, which became the "City of David."

As king, David gave his attention first to conquering the hostile nations by which he was surrounded, so Israel could have peace. He was so successful in this that within a few years all these nations were subdued, the boundaries of Israel were extended to their greatest limit, and the nation became supreme in that part of the world.

David next gave his attention to strengthening the laws and the religious life of the people. He brought the Ark to Jerusalem, and made that city the religious as well as the civil capital of the nation. He is supposed to have written the Twenty-fourth Psalm at the time of bringing up the Ark. He asked of God the privilege of building a temple for His worship, but because he had been a man of war this was denied him. He was, however, permitted to make the plans and collect much of the material, which his son and successor, Solomon, wrought into the magnificent Temple of Jehovah (see TEMPLE).

The Psalms. David was said to have composed at least seventy-three of the Psalms, which are still read and sung wherever the Bible is known, and their influence upon the Christian world is beyond estimate. He arranged the praise service for the sanctuary and is said to have been the originator of the orchestra.

Estimate of His Character. David was the greatest king of his time, and by many authorities is considered to have been the greatest king the world has ever known. He was not a perfect man, for, like other men, he sinned, and suffered for it. But when he was convinced of wrong-doing he was great enough to repent and obtain forgiveness. He reigned forty years and prepared for the accession of Solomon to the throne. This great ruler was one of the ancestors of Christ, "Great David's Greater Son." His farewell words to Solomon embody the chief characteristics of his own life—"Be thou therefore strong and show thyself a man." W.F.R.

DAVID, JACQUES LOUIS (1748-1825), a French painter, known as the father of the modern French school of painting. Among the celebrated paintings that he completed while studying in Rome were the *Death of Socrates* and the *Oath of the Horatii*. During the French Revolution he was the artistic decorator of the national fetes which were founded on classic customs. In 1789 he completed the painting of Brutus condemning his sons to death, and in 1799 executed *The Rape of the Sabines,* receiving, it is said, 100,000 francs from its exhibition. He was directed by the emperor in 1804 to execute four commissions, and among the paintings executed in response to this order, *Napoleon's Coronation* remains distinguished. During the Reign of Terror he was a zealous member of the Jacobin party, and at the trial of King Louis XVI, sitting as one of the judges, he voted for his death. For this act he was banished to Brussels, where he died in exile in 1825.

DAVIES, *da'veez,* SIR LOUIS HENRY (1845-), a Canadian barrister, statesman and jurist, puisne judge of the Dominion Supreme Court since 1901. He was born at Charlottetown, Prince Edward Island, attended the Prince of Wales College in that city and studied law at the Inner Temple, London, England. He was called to the bar of Prince Edward Island in 1867, in 1875 and 1876 was leading counsel for the tenants before the commission which settled the land question in Prince Edward Island, and in the next year was counsel for Great Britain before the International Fisheries Arbitration Commission. Many years later, though better known as a political leader, his legal ability was recognized by appointment to the Joint High Commission which met in 1898 and 1899 for the settlement of all disputes between Canada and the United States.

Sir Louis's political career began in 1869, when he was for a short time solicitor-general of Prince Edward Island. From 1872 to 1879 he was a member of the provincial assembly, part of the time leader of the Liberal opposition, and from 1876 to 1879 was premier and attorney-general. He was elected to the Dominion House of Commons in 1882, and served without interruption until 1901, when he accepted appointment to the Supreme Court. From 1896 to 1901 he was Minister of Marine and Fisheries in the Laurier Ministry. In this capacity he undertook several diplomatic missions, notably in 1896, when he went to Washington in the interest of reciprocity, and in 1897, when he was joint delegate with Sir Wilfrid Laurier for the settlement of the Bering Sea Controversy (which see). He was created a Knight Commander of the Order of Saint Michael and Saint George by Queen Victoria in 1897. G.H.L.

DAVIS, DAVID (1815-1886), an American statesman and Supreme Court justice, the personal friend of Abraham Lincoln, of whose estate he was executor. Davis was born in Maryland. After his graduation from Kenyon College, Gambier, O., he studied law, beginning practice at Bloomington, Ill. In 1844 he was elected to the Illinois legislature; after 1848 he served as judge of the circuit court for three terms, and in 1862 was appointed by President Lincoln to the Supreme Court. Though he usually voted with the Democrats,

DAVIS, JEFFERSON (1808-1889), an American soldier and statesman, President of the Confederate States of America, a man who "in his person and history symbolized the solemn convictions and tragic fortunes of millions of men." The people of the South remember with admiration his gallant service on the battlefields of Mexico; they are glad to recall his career in the United States Congress in the House and Senate, where he proved himself worthy to be grouped with Clay, Webster, Calhoun and the other "giants" of an illustrious period; they are proud of his record as head of the War Department during the Presidency of Franklin Pierce, and they cherish the memories that cluster about his stainless life and character. But more than this, Jefferson Davis won a place in their hearts that possibly no other man can fill. For his people he went to prison; for them he endured hatred, slander and ill-treatment. For this he has won their undying love.

He was born June 3, 1808, in that part of Christian County, Kentucky, which was later organised as Todd County. The Baptist church of the little town of Fairview now occupies the site of the house in which he was born. His father, a veteran of the American Revolution, was of Welsh descent; his mother came of Scotch-Irish ancestry. During the infancy of the boy the family removed to Wilkinson County, Mississippi, the state with which his fame will forever be associated. He completed the course of study in the county academy, then entered Transylvania College, Kentucky, and at the age of sixteen was appointed to the United States Military Academy at West Point. Four years later, in 1828, he was graduated, and immediately entered active army service with the rank of lieutenant.

Assigned to duty out on the northwestern frontier, Davis took part in the campaigns against the Indians, and was present at the capture of Black Hawk. Resigning from the army in 1835, he married the daughter of Zachary Taylor, and settled down to the quiet life of a Mississippi cotton planter. Four months after his marriage he lost his wife by fever, and he himself barely escaped the same fate. As soon as he had recovered he traveled for about a year in order to restore his health. In 1836 he returned to his plantation, where he spent several years in farming, reading and studying political economy and political philosophy, and by careful management he acquired considerable wealth.

In 1843 Davis entered the field of politics and in 1845 he was elected to the national House of Representatives. From the beginning of his political career he stood firmly for strict construction of the Constitution, and he gave his loyal support to John C. Calhoun.

During his term of office hostilities with Mexico commenced, and in June, 1846, Davis resigned his seat in Congress and took command of a regiment of Mississippi volunteers, as its colonel. He served in Mexico under General Taylor, distinguishing himself for gallantry in the battles of Monterey and Buena Vista. In the latter engagement he fought all day long with a bullet in his foot, and returned home after the war on crutches.

Judge Davis was nominated for the Presidency in 1872 by the National Labor Reform Party. In 1877 he resigned from the Supreme Court to succeed John A. Logan in the United States Senate, and held the office until 1883. When, on the death of Garfield, Vice-President Arthur succeeded to the Presidency, Judge Davis became presiding officer of the Senate.

In 1847 the governor of Mississippi appointed Davis successor to a United States Senator who had died; the following year he was elected by the Mississippi legislature for the remainder of the term, and in 1850 for a full term. In that year the famous compromise measures fathered by Henry Clay came before the Senate. Davis took an active part

JEFFERSON DAVIS
Soldier, statesman and President of the Confederate States of America.

in the debates, arguing against the measures and coming frequently into opposition with Senator Douglas of Illinois, whose theory of squatter sovereignty he held to be unsound. In 1851 he resigned from the Senate to become the candidate of the States'-Rights Democrats for the governorship of Mississippi, and was defeated by a small majority after a stirring campaign that attracted the attention of the nation.

In 1853, at the beginning of the administration of Franklin Pierce, Davis was appointed Secretary of War, and for four years performed the duties of that office with distinction. He introduced an improved system of infantry tactics, brought about the substitution of iron for wod in gun carriages, effected an increase in the army, organized engineer companies to explore the proposed routes for a railway connecting the Mississippi Valley with the Pacific Ocean and strengthened the coast and frontier defenses. At the close of his term of office he was reëlected to the Senate, where he became the recognized spokesman of the South and the champion of the doctrine that a state has the right to choose and maintain its own institutions, without interference from the general government. Calhoun, the great defender of the states' rights theory, had passed away, but the Southern cause found an able and eloquent champion in the Senator from Mississippi.

With the election of Abraham Lincoln to the Presidency of the United States, the anti-slavery struggle reached a crisis, and when Mississippi passed the ordinance of secession, Davis resigned from the Senate. His last speech, delivered on January 21, 1861, was a noble expression of his belief in the righteousness of the Southern cause, and yet it was with sincere regret that he bade his associates farewell.

Shortly after his return to Mississippi he received news of his election as provisional President of the Confederate States. He was inaugurated on February 18, 1861, and a year later was elected permanent President. His career as chief executive showed his ability and his high sense of honor and of duty; the labors and trials he endured are faithfully portrayed in his *Rise and Fall of the Confederate Government,* published in 1881. Throughout the war he acted with dignity, sincerity and devotion to principle, and he endeavored with

HOME OF JEFFERSON DAVIS AT BEAUVOIR
In 1879 Mrs. Dorsey, of Beauvoir, Miss., bequeathed her estate to Mr. Davis, and here he lived quietly for the ten years preceding his death.

all the force of his nature to lessen the suffering that was an inevitable feature of the bitter struggle.

Soon after the surrender of General Lee, Davis was taken prisoner and was confined in

Fortress Monroe. A Virginia grand jury indicted him for treason, and for two years he remained in prison, unable to secure a trial. In 1867 he was released on bail, Horace Greeley and other prominent Northern men qualifying as bondsmen. He was included in the general amnesty of 1868, and in February, 1869, was given full liberty.

His last years were spent in dignified retirement, in which he gave himself up to writing and study. He died on December 6, 1889, and was buried in New Orleans,

IN MEMORY OF WINNIE DAVIS
The monument to the "Daughter of the Confederacy," at Richmond.

but in 1893 his body was removed to Richmond, where a monument has been erected to his memory. In the same city is a monument to his daughter Winnie. In 1844 he had married a daughter of William B. Howell, son of Governor Howell of New Jersey. This gifted woman, whose noble spirit matched her husband's, wrote an excellent biography of the great Southern leader. E.C.B.

The following books will be interesting to those desiring a fuller account of Jefferson Davis' experiences: Craven's *Prison Life of Jefferson Davis*, and the biographies of Dodd and Alfriend.

Related Subjects. The following articles in these volumes will make more clear certain phases in the career of Jefferson Davis:

Black Hawk	Monterey, Battle of
Calhoun, John C.	Nullification
Compromise of 1850	Secession
Confederate States of America	Squatter Sovereignty
Fort Monroe	States' Rights
Mexican War	War of Secession

DAVIS, REBECCA HARDING and RICHARD HARDING, mother and son, two writers who have won distinction in current American literature.

Rebecca Harding Davis (1831-1910) was the wife of L. Clarke Davis, editor of the Philadelphia *Inquirer*. Her first story, *Life in the Iron Mills*, published in the *Atlantic Monthly* in 1861, attracted wide attention because of its realism, and it marked the introduction of a new theme in American fiction—the labor question. She contributed to several current publications, notably *The Youth's Companion*, winning fame through her interesting stories for young people. Among her books are *A Law Unto Herself, Kitty's Choice, Dallas Galbraith, Kent Hampden* and *Bits of Gossip*.

Richard Harding Davis (1864-1916) held high rank among modern short-story writers and as a war correspondent. He was born in Philadelphia, Pa., and was educated at Johns Hopkins and Lehigh universities. His real foundation for his literary work, however, came in his experience as a reporter in Philadelphia and as a war correspondent for the London *Times* and the New York *Herald* in the Turkish-Greek, Spanish-American, Boer and Russo-Japanese wars and in the early months of the War of the Nations. While on the latter assignment he proved himself one of the greatest of war correspondents. He was a trained and alert observer, and drew his word pictures with bold and telling strokes, revealing a keen sense of the dramatic and a gift for vigorous and picturesque phrasing.

RICHARD HARDING DAVIS

Among the best-known of his stories are *Ranson's Folly*, a tale of the adventures of a young officer at a United States army post, and *The Bar Sinister*, a remarkable story of a dog. Other notable titles are *Van Bibber and Others, Soldiers of Fortune, Captain Macklin, The Man Who Could Not Lose* and *The Lost Road*. His books of travel and stories of his war experiences, which have all the admirable qualities of his fiction, include *Cuba in War Times, With Both Armies in South Africa* and *The Congo and the Coast of Africa*. He has also written several plays, among which are *The Taming of Helen, The Dictator* and *Blackmail*.

DAVITT, *dav'it,* MICHAEL (1846-1906), an Irish political leader, founder of the Irish Land

League. His parents had been evicted from their home for non-payment of rent when he was a child. This event embittered his whole life, and aroused in him a hatred of everything English. While working in a cotton mill in Lancashire he lost his right arm. He found work, however, in a printing office and educated himself in his spare time. He visited America several times to obtain assistance in the organization of the Land League, and in 1870 was sentenced to fifteen years' imprisonment for bringing arms into Ireland. Liberated in 1877, he still continued his bitter campaign against landlordism and was again imprisoned. He was elected to Parliament on several occasions, but was refused admission. Later he was returned unopposed, but bankruptcy necessitated his resignation. He was a prolific writer, but his bitterness shows clearly in all his works. His writings include *Defense of the Land League* and *Leaves from a Prison Diary*.

DAVY, *da'vi,* **Sir Humphry** (1778-1829), an English chemist whose invention of a safety lamp for use in mines is one of the greatest gifts of science to mankind. At the age of twenty-two he was appointed lecturer to the Royal Institution of London, and a year later was made its professor of chemistry. His researches and experiments gained for him a great reputation. At a time when England and France were at war he was invited to visit the latter country, and there he was received with the greatest respect. He was knighted and married a lady of great wealth, and was thus enabled to devote all his energies to scientific research. He decomposed potash, soda and strontia and set free the metals which form the base of this large group of compounds. This achievement placed him above all other chemists of his time. After thoroughly investigating fire damp, he produced the Davy lamp, which made miners comparatively safe from explosions. His brilliant assistant, Michael Faraday, succeeded him at the Royal Institution, and carried to a successful termination many experiments begun by him.

DAW'SON, or DAWSON CITY, the seat of government for Yukon Territory and the commercial center of the Klondike region. It is located on the right bank of the Yukon River, at its confluence with the Klondike. It is about fifty miles east of the Alaska boundary, [illegible]nd 360 miles in a straight line northwest of [illegible]way. A railway is in operation to Bo[illegible]twelve miles distant. During the sum[illegible]ths steamers run from Dawson to White Horse, 460 miles southeast, the head of navigation on the Yukon River and the terminus of the White Pass and Yukon Railway, and in winter there is connection overland by sleighs and stage coaches.

Dawson owes its existence to the discovery of gold on Bonanza Creek on August 16, 1896. A town sprang up almost over night, and when the gold rush was at its height its population was not far from 20,000. The town is still the receiving and supply center for the Klondike, and in many ways is a typical mining center, though there has never been, even in the feverish days of 1896 and 1897, lawlessness and violence to the extent usually characteristic of such communities. Order is maintained by the Royal Northwest Mounted Police. Dawson was incorporated in 1899, surrendered its charter in 1903, and was again incorporated in 1914. It was named for George M. Dawson, a distinguished Canadian geologist (see below). Population in 1911, 3,013; in 1916, about 4,000. G.B.

DAWSON, Sir John William (1820-1899), a Canadian geologist and educator, for nearly forty years principal of McGill University, which attained high rank under his administration. He was born of Scotch parents at Pictou, in Nova Scotia, and went to Scotland to study at the University of Edinburgh, from which he was graduated in 1842. After his return to Canada in that year he accompanied Sir Charles Lyell on several geological expeditions, and made a special study of the fossil forests of the coal measures of Nova Scotia. From 1850 to 1853 he was superintendent of education for that province, and in 1855 became professor of geology and principal of McGill University, which became, largely through his efforts, one of the leading universities of America. Though he did not resign this position until 1893, he found time to write a score of of books and scientific monographs. Particularly in the field of Canadian geology, a subject on which he wrote often, he became a recognized authority. Among his published works are *Acadian Geology; Air-Breathers of the Coal Period; The Dawn of Life; The Canadian Ice Age,* and *The Story of the Earth and Man.* Dawson was the first president of the Royal Society of Canada and received honors from other scientific associations in all parts of the world.

His son, **George Mercer Dawson** (1849-1901), was also distinguished as a geologist and explorer. He was born at Pictou, and was

educated at McGill University and the Royal School of Mines, London. In 1873 he was appointed geologist and naturalist to the North American Boundary Commission, and in 1875 became a member of the staff of the geological survey of the Dominion, later becoming assistant director and in 1895 its director. He was in charge of the Canadian government's Yukon survey in 1887, and Dawson City is named for him. In 1891 he took an important part in the arbitration of the controversy regarding the seal fisheries in the Bering Sea. He was the author of many scientific papers and reports, especially on the surface geology and mineral formations of Northern and Western Canada. G.H.L.

DAY, the period of time required for the earth to make one revolution on its axis, or twenty-four hours. In law a day is generally considered to extend from midnight to midnight, but a *business* day includes only the business hours customary in any given locality. Also, *day* may mean the period during which the sun is shining upon a given portion of the earth, or the period of daylight. The light is called *day* and the darkness *night*. In the temperate and the polar regions the days and nights vary in length; at the equator they are of equal length. See SEASONS.

For business and all other ordinary purposes in most parts of the world the day of twenty-four hours is divided into two periods, the forenoon (A. M.) extending from midnight to noon, and the afternoon (P. M.) extending from noon to midnight. The railroads in Western Canada arrange their schedules on a twenty-four hour day, numbering the hours from one o'clock A. M. to twenty-four o'clock. The twenty-four hour day is also official in France.

Astronomers use a day measured by the time required for the earth to make a complete revolution on its axis in reference to a fixed star. Since the star is so far away that the movement of the earth in its orbit is practically unnoticeable in reference to it, this day is a little shorter than our civil day of twenty-four hours. It is exactly 23 hours, 56 minutes, 4.098 seconds, and is known as the *sidereal* day. Instead of writing 1 P. M., the astronomers would write the *thirteenth hour*.

The Babylonians began the day at sunrise, the Jews at sunset, and the Egyptians and Romans at midnight. The Chinese divide the day into twelve periods of two hours each.

DAY, WILLIAM RUFUS. See illustration, with biography, in article SUPREME COURT.

DAY LILY, a hardy, sun-loving, lilylike plant whose beautiful tawny-orange, white or blue-lilac blossoms live but from the rise of sun to its setting. So the appropriate family name, *Hemerocallis*, from the Greek, meaning *beautiful for a day*, suggested the popular name.

The day lily is a native of Europe and Asia, but it has been cultivated in America. Away from gardens and in a wild state the orange-colored species, especially, is seen along streams and in meadows, masses of sunshine among the weeds, from New Brunswick to Virginia and from Ontario to Tennessee.

Long leaves, in some species grasslike, spring from fleshy, fibrous roots. The flowers appear in loose clusters at the top of a leafless stalk three to five feet high, six or twelve in a cluster, two or three opening each day. They are funnel-shaped, like a lily, six-parted, with six stamens and long-stalked, heavily-pollened anthers. Day lilies are hardy, easy to cultivate, and in good rich soil in a moist shady spot make excellent border plants, giving a continuous wealth of blossoms from June to September. For explanation of botanical terms, see FLOWERS.

DAY'TON, OHIO, a leading manufacturing city and the county seat of Montgomery County. It is situated in the southwestern part of the state, on the east bank of Great Miami River, at the point where it receives the waters of Mad River; it is also on the Miami & Erie Canal. Cincinnati is sixty miles southwest, Columbus is seventy-two miles northeast, and Toledo, 147 miles slightly northeast. The city is served by the Cleveland, Cincinnati, Chicago & Saint Louis; the Cincinnati, Hamilton & Dayton; the Pennsylvania; the Dayton & Union, and the Erie railways; and seven electric lines center here. The rivers are spanned by five concrete bridges. Dayton has a growing population, chiefly American, which increased from 116,577 in 1910 to 127,224 in 1916. The area exceeds fifteen and a half square miles.

Industrial Enterprise. Dayton, though fifth in population among the cities of the state in 1910, ranked third in invested capital for manufacturing, in the value of manufactured products and in the number of workmen employed. One of the chief factors of prosperity is the abundant water power afforded by Mad River, through hydraulic canals. The surrounding country is an agricultural district, fruits, vegetables and tobacco being extensively

cultivated. Limestone and marble quarries produce large supplies of excellent building material. Dayton's manufacturing industries are numerous, varied and extensive; many factories employ from 500 to 2,500 people. The National Cash Register Company and the railroad car factories lead in extent of manufacture. Agricultural implements, architectural iron work, sewing machines, foundry products, automobiles, computing scales, paper, cotton and woolen goods and linseed oil are other important products.

Homes, Parks and Boulevards. Dayton is an attractive city that suggests the home-lover. There are a dozen or more building associations, its interest in these institutions being greater than that of any other city of its size. A large number of $20,000 homes have been built by this method. Its streets are broad, some being 180 feet wide; Miami and Robert boulevards and the park boulevard along the river are especially attractive. Dayton's park system covers an area of about 700 acres and includes Cooper, Van Cleve, McKinley and McCabe parks and White City. There is also access to the grounds (640 acres) of the National Military Home, which accommodates about 6,000 war veterans. A handsome soldiers' monument is one of the attractions of the city.

Buildings and Institutions. The most notable buildings are the Federal building, erected in 1913 at a cost of $1,000,000, the Union Station, opened to the public in 1900, the old courthouse, modeled after the Parthenon, with a large annex, and Memorial Hall. Dayton State Hospital, the insane asylum, Miami Valley Hospital and Saint Elizabeth's Hospital are among the benevolent institutions. The Y. M. C. A. building cost $600,000. There are about 100 churches, many of them of unusual architectural beauty, and some fine hotels, bank and office buildings.

Education. Besides its public school system the city has Notre Dame Academy, Saint Mary's College, Bonebroke Theological Seminary, Central Theological Seminary, a manual training school, twelve parochial schools for Roman Catholics and Lutherans and four business colleges, one of which was established in 1860. The first library incorporated in the state was established at Dayton in 1805. The public library and museum, in Cooper's Park, contains 100,000 volumes and is supplemented by two branch libraries.

History. In November, 1796, the present city of Dayton was laid out by General Israel Ludlow and a party of Revolutionary soldiers. It was incorporated in 1805 and named for General Jonathan Dayton, one of the first settlers. The city charter was granted in 1841. An epidemic of cholera visited Dayton in 1849, and it has been damaged by floods several times; the most serious disaster from this source occurred in March, 1913, when the city sustained a loss of $128,000,000. Within two weeks a fund of $2,000,000 was raised by public-spirited citizens for flood prevention. A plan is under way to obviate even lesser dangers throughout the Miami Valley by a system of dry reservoirs, the construction of which will cost about $20,000,000. Dayton adopted the commission form of government in 1913. Five elective officers appoint a city manager, who is personally responsible for the administration of the government (see CITY MANAGER). W.G.L.

DEACONESS, *de'k'n ess,* a member of a religious Order connected with several of the Protestant churches. The Order is composed of women who devote their lives to serving the people under the direction of the Church, in special fields in which pastors cannot work. They have definite centers of work called *deaconess homes,* where they live as communities and where those who need their services are always able to find them. Their chief duties consist in nursing the sick who cannot pay for such assistance and in ministering to the spiritual and material necessities of the distressed and needy. The members usually wear a distinguishing costume, though it is inconspicuous, but they do not take any vows as to time of service. They are required to take a two-years' course of study in special training schools to prepare them for their work and are inducted into the Order by the authorities of the Church to which they belong.

The deaconess movement was inaugurated in modern times in the first half of the last century by Pastor Fliedner of the United Evangelical Church of Prussia. The first deaconess home in America was established by the Lutheran Church in New York in 1852. The next was founded by Saint Andrew's Episcopal Church in Baltimore in 1855. In 1888 the General Conference of the Methodist Episcopal Church authorized the establishment of the Order, and the first Methodist deaconess home was founded in Chicago. The Order was given a warm welcome by this Church, which now is far in the lead of all other denominations in deaconess work.

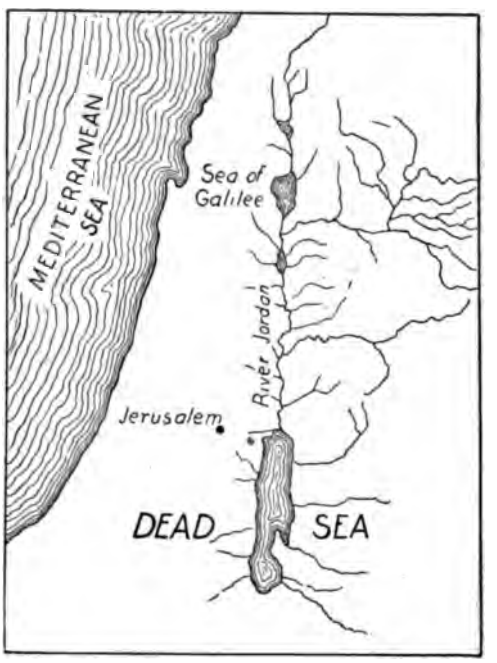
DEAD-LETTER OFFICE, a division of the Postoffice Department of a country, where all mail matter which is unclaimed or cannot be delivered is sent from the local post offices throughout the country. This matter includes letters and packages which have remained for one month uncalled for; all that are imperfectly addressed or are without stamps, unless sender is known; also all articles barred from the mails—liquids, live animals and explosives. Excluded from the above are all pieces of undelivered mail matter which bear the names of the senders and can thus be returned to them.

The amount of mail matter which the Dead-Letter Office of the United States receives runs into millions of pieces annually. Statistics for a recent year show that 7,500,000 pieces of undeliverable mail were sent to the Dead-Letter Office, 5,400,000 of this number being letters and parcels. Over 250,000 of the letters contained money, checks, notes and money orders. Of these the government, by opening letters and packages, was able to return to the senders sums amounting to $1,150,000. There was still left in the government's hands $15,000, which was added to the revenue of the postal department because its ownership could not be established. Over 4,000,000 pieces were destroyed because they were without names. Thousands of misdirected magazines and newspapers are distributed among the hospitals of Washington yearly.

This department of the postoffice is under the control of the First Assistant Postmaster-General. Until January 1, 1917, the Dead-Letter division was controlled entirely from Washington, but on that date three branches were established—at New York, Chicago and San Francisco—to handle all dead-letter material within specified zones.

DEAD SEA, a salt lake or sea in the southeastern corner of Palestine, wholly unlike any other body of water in the world. It lies at the bottom of the deepest "fault" or fracture of the earth's surface in the world—1,310 feet below sea level. The River Jordan, the most noted stream in history, flows into it from the north through a rapidly descending valley. On the east the white limestone walls of the plain of Moab rise abruptly 4,400 feet above it, while the plateau of Judea towers half that height on the west.

The lake itself is about forty-seven miles long and ten miles wide, with an area of 300 square miles. The water contains about twenty-five per cent of solid matter, chiefly common salt, which is practically double the percentage of salt in the Great Salt Lake, Utah. It is nearly six times as salt as the ocean and so dense that a human body will float on the surface. Although the Jordan pours several million gallons of fresh water into the Dead Sea every day and the sea itself has no outlet, the water never rises any higher and never grows less salty. This condition is due to evaporation, because the heat in this deep cleft of the earth is very intense. There is not a vestige of animal life in the sea or in its vicinity, and no vegetation can grow there. Sulphur and rock salt and lava strew its shores. Poisonous gases escape from its surface, and



LOCATION MAP

the water is ill-smelling. Altogether there is no place in the world more utterly desolate and repelling. So much has this been recognized that "Dead Sea" has become a synonym for evil and bitter disappointment.

It has a long history, dating away back into earliest ages. The tradition of its formation may be read in *Genesis,* where it is told that the wicked cities of Sodom and Gomorrah were destroyed, after the escape of the righteous Lot and his family, by a rain of fire and brimstone (perhaps a volcanic eruption) and that they were covered up by the "Salt Sea." To this day the Arabs call it *Bahr Lut*—sea of Lot.

DEAF AND DUMB, or DEAF-MUTES, are those persons who can neither hear nor speak. Those who are born deaf or become so in infancy suffer from the additional affliction of dumbness because they cannot hear others speak, and therefore do not learn to articulate words. Mutes of this class are to be distinguished from those whose lack of speech results from defects of the speech centers in the brain, or from imperfect organs of articulation. When deafness comes upon those who have already learned to talk they retain the power of speech, though the voice often becomes harsh and unnatural. Mutes who are taught to articulate words do not acquire a perfectly-natural speaking voice, the rising and falling inflections which give variety to the speech being more or less absent.

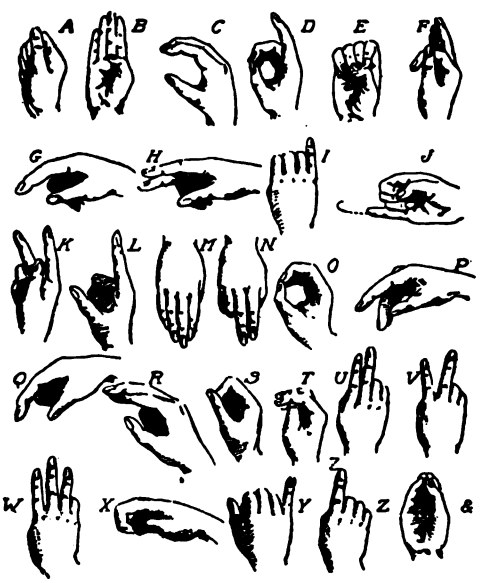
Causes of Deafness. The deaf are grouped into two classes—those who are born deaf and those who lose their hearing after birth. The former are afflicted with what is called *congenital* deafness, or deafness from birth; the latter with *accidental,* or *acquired,* deafness. In the first case the harm is done before the birth of the child, who suffers from what is known as arrested development. In some instances, physicians agree, this condition exists as a family trait, due to alcoholism, insanity or certain forms of disease, notably syphilis, and the deafness is transmitted by heredity. The intermarriage of near relatives, who inherit similar tendencies to disease, is a very common cause of deafness at birth. It is estimated that about twenty-five per cent of the deaf-mutes of France and ten per cent of those in the United States, Canada and England are the children of near-related parents.

Acquired deafness, which occurs at all ages, may be permanent or temporary, partial or complete. Sometimes only one ear is affected, in which case the person is not seriously handicapped. Acquired deafness is often a process of slow development, the hearing failing gradually and perhaps never ceasing wholly, though the sufferer may hear with difficulty.

These varying conditions are due chiefly to (*a*) deposits of wax in the ear, which touch the membrane of the drum; (*b*) inflammation of the lining membrane of the canals (Eustachian tubes) that lead from the upper part of the throat to the middle ear (see EAR, subhead *Middle Ear*); (*c*) piercing of the drum membrane; (*d*) disease of the middle ear, causing the joints of the small bones of the ear (ossicles) to stiffen and interfering with their movements; (*e*) disease of the auditory nerve or of the brain, whereby some of the auditory centers are affected; (*f*) other diseases, such as spinal meningitis, scarlet fever, measles or mumps, which affect the middle ear. Sometimes a violent blow upon the ear causes deafness by rupturing the drum, and a constant noise, as that in a machine shop or the incessant roar of battle, may produce loss of hearing by overstimulating the auditory nerve.

The Education of Deaf-Mutes. *Historical.* Shut in within himself and unable to communicate freely with his fellows, the deaf-mute of early historical times was a pitiable object, considered by the law to have no more intelligence than a madman. The Greeks and Romans put their deaf-mutes out of the way as so many useless encumbrances, and in France the parents of these unfortunates regarded them as a family disgrace and shut them up in convents and asylums. It would seem that Christ was the first to have compassion on these defectives, for among His works of mercy were the opening of the ears of the deaf and the loosening of the tongues of the dumb.

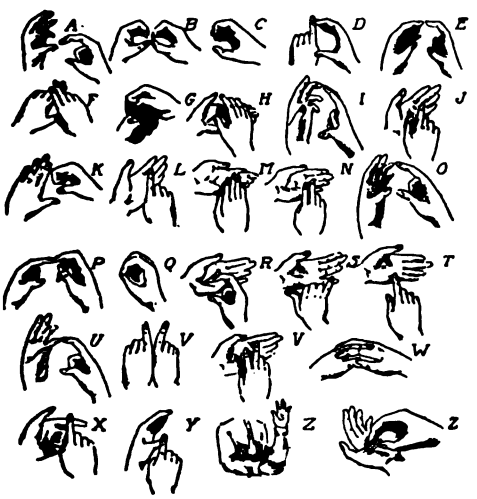
Probably the first person who attempted to educate the deaf was an English bishop of the



DEAF AND DUMB ALPHABET
For one hand.

seventh century, who, according to a story told by the Venerable Bede, performed a miracle by teaching a deaf-mute to talk. Then, after a lapse of many centuries, an Italian philosopher, Jerome Cardan (1501-1576),

aroused the interest of the public in the subject by declaring, authoritatively, that "written characters and ideas may be connected together without the use of sounds." Cardan also pointed out that deaf-mutes were normal beings in intelligence. Shortly after this a Spanish Benedictine monk gave regular instruction to the deaf and dumb, whom he taught, as he said, "to speak, read, write, reckon, pray, serve at the altar, know Chris-



DEAF AND DUMB ALPHABET
For two hands.

tian doctrine and confess with a loud voice." Another Benedictine monk, Juan Bonet, published in 1620 what is probably the first treatise on the education of deaf-mutes. These pioneer teachers used signs, pantomime and finger-spelling.

In 1648 the first English treatise on the subject was published by Dr. John Bulwer, and the movement in Europe was fairly started with the establishment of a school for poor deaf-mutes in Paris, in 1760. The founder of this school, Charles-Michel de l' Epée, is one of the greatest benefactors the deaf have ever had. Eighteen years later the first public institution was opened in Leipzig. It was not until early in the nineteenth century, however, that the education of the deaf and dumb was placed on a systematic, organized basis. At the present time institutions for the deaf are maintained in practically every country in Europe, and a few schools have been opened in Japan and China.

In America, Connecticut led the way, the first permanent school for the instruction of the deaf being opened at Hartford in 1817. A few years previous to this an unsuccessful attempt had been made to found such a school in Virginia. New York and Massachusetts were the next states to begin the systematic education of deaf-mutes, and now every state in the Union has one or more institutions in which they receive instruction. Public day schools for the deaf are maintained in California, Georgia, Illinois, Massachusetts, Michigan, Missouri, New Jersey, New York, Ohio, Oregon, Texas, Washington and Wisconsin. In the number of deaf-mute institutions the United States leads the countries of the world, with over 150 state institutions, public day schools and private schools. Some authorities believe that the deaf and the hearing should be taught together in the same school, interesting experiments along this line having been made in Chicago, Milwaukee and New York.

Schools for the deaf are maintained in several cities of Canada, particularly Montreal, Quebec, Toronto, Winnipeg and Victoria.

Attention is also being given to the development and training of the residual hearing that exists in the cases of very many so-called deaf-mutes. This is, perhaps, their most valuable possession, as it supplies the only normal means of access to the speech centers of the brain. It has been found by patient effort that an amount of hearing so slight as to be overlooked by the average physician and parent can be so educated as to develop in the child's brain a considerable ability to interpret speech by ear and to modify the speaking tones.

Methods of Instruction. The education of the deaf and dumb is carried on by means of two general methods, the *sign* and the *articulation* methods. When the former is used, ideas are communicated through the medium of gesture, facial expression and pantomime, and by means of the manual alphabet, whereby the pupil is taught to spell with his hands. The two forms of the manual alphabet, the one-handed and the two-handed, are shown in the accompanying illustrations.

The articulation method is used both in teaching the deaf-mute to understand what is said to him and in teaching him to speak. By watching the motions of the lips of his teacher, he learns to interpret what is said, though he cannot hear the words. This method of interpretation is known as lip reading. One who has acquired a mastery of it can understand a public lecturer, if he is not too far from the speaker, and also the utterances of the actors in a moving-picture play. Those who have

always heard can scarcely appreciate what the mastery of lip reading means to a deaf person in just the ordinary routine of life. Experience has demonstrated the truth of what theory indicates, that the best results in speech and lip reading cannot be attained by the deaf when any use is made of the sign language or finger spelling during the educational period. For this reason the use of silent methods of communication is steadily decreasing in the schools for the deaf, and in ninety-five of the schools in the United States no use whatever is made of the sign language or finger spelling.

Mutes are taught to speak by observing the lips and other vocal organs of the teacher, and then imitating the motions. When certain sounds are pronounced the pupil touches the teacher's throat, thus being better able to imitate the vibration and position of the muscles. The Wright Oral School of New York City is one of the best oral schools for the deaf.

The Bell system, invented by A. Melville Bell of Edinburgh and introduced into America in 1872 by his son Alexander Graham Bell, consists of a series of alphabetical characters based on the position of the vocal organs when they are in motion. These characters suggest to the eye the mechanical process of speech in the formation of all the sounds that can be uttered.

For many years after schools for the deaf were established, pupils were not admitted until they were eight or ten years of age. Gradually it was realized that school instruction should begin at about five years of age, but the years between birth and school age were practically wasted, from the standpoint of language acquisition. Recently, a body of literature has become available for the instruction and guidance of parents of deaf children in their training at home before they are of school age. Among works of this character are John D. Wright's *What the Mother of a Deaf Child Ought to Know,* and late volumes of the *Volta Review,* published in Washington, D. C., by the Volta Bureau.

What can be accomplished in the education of the deaf and dumb is strikingly shown in the achievement of Miss Helen Keller. Though deaf and dumb from infancy and blind after the age of nineteen months, she is a college graduate and successful writer, and is a lecturer of note. J.D.W.

Consult Garrett's *Directions to Parents of Deaf Children;* Bell's *Deaf Mute Instruction in Relation to the Work of the Public Schools.*

Related Subjects. The reader is referred to the following articles in these volumes:

Bell, Alexander Graham Keller, Helen Adams
Bridgman, Laura Dewey Sign Language

DEARBORN, HENRY (1751-1829), an American soldier and physician, born at Northampton, N. H., distinguished as a Revolutionary hero, and honored by having Fort Dearborn, on the site of Chicago, named for him. On hearing of the Battle of Lexington on April 20, 1775, he marched to Cambridge, a distance of sixty-five miles, with a company of volunteers and was made a captain. He served at the Battle of Bunker Hill, accompanied Arnold to Quebec and was major under Gates when Burgoyne was captured. By a gallant charge at the Battle of Monmouth he distinguished himself and his regiment. In 1780 he took part in Sullivan's Indian expedition in Western New York and was in the final Yorktown campaign. He was twice a member of Congress, and was Secretary of War in Jefferson's Cabinet (1801-1809). Becoming a major-general in the War of 1812, he was honored as senior officer of the United States army until his honorable discharge in 1815. In May, 1822, he was sent as minister to Portugal, but at his own request was recalled after two years.

DEATH. In all plant and animal life there is a time when the vital functions cease to exist. This is called *death.* The physiologist says that the final cause of death in man is the stopping of the heart's action, which results in the arrest of the circulation and the death of the bodily tissues through lack of nourishment. The average person thinks of death as the final episode in the drama of life; comparatively, he pictures life as a long line, and death a mere dot at the end of it.

When Death Begins. As a matter of fact, death begins with birth, for throughout the span of life every part of the organism has its period of vitality and decay, and in continuous succession old cells are destroyed and new ones are formed in all the bodily tissues. Speaking figuratively, life and death are engaged in a struggle that ends only when death is finally victorious. Sometimes death is aided by disease, accident or violence, but even when man lives to old age, life must finally succumb to the forces of decay. This is the period, wrote the author of *Ecclesiastes,* "when the keepers of the house shall tremble, and the strong men shall bow themselves, and the grinders cease because they are few, and those that look out of the windows be darkened."

Its Meaning. Man, fascinated by the spiritual meaning of death, from the very beginning of time has formulated theories concerning the great "undiscovered country, from whose bourn no traveler returns." To the believer in the immortality of the soul death is what Longfellow expresses so beautifully in his *Resignation:*

There is no Death! what seems so is transition;
This life of mortal breath
Is but a suburb of the life elysian
Whose portal we call Death.

It is instinctive in human nature to believe that the soul lives again after the death of the body. For some of the theories which have had their origin in this belief, see IMMORTALITY; TRANSMIGRATION OF THE SOUL.

In Literature and Myth. In legend Death has usually been personified as the great enemy of mankind. Sisyphus, in the old Greek tale, bound Death in chains when he came to bear him away, and no one on earth died until Mars came and freed the captive. In Italian folklore stories Death is tied up in a bag and corked in a bottle by his enemies. A German variation of this tale occurs in the story of Gambling Hansel, who kept Death up a tree for seven years. In Chaucer's *Canterbury Tales* the story told by the Pardoner is that of three roysterers who planned to seek out Death and slay him because he had killed an old comrade of theirs.

Death and its various aspects have been a favorite theme of poets, and have inspired many passages of high lyric beauty. It is an interesting fact that poems treating of death nearly always sound the optimistic note, and are more courageous and cheerful in tone than many whose theme is life. This is notably true of such well-known poems as Bryant's *Thanatopsis* (whose title means *contemplation of death*), Browning's *Prospice,* Tennyson's *Crossing the Bar* and Stevenson's *Requiem,* and it is beautifully illustrated in the following lines from an English poet, William E. Henley (1849-1903):

So be my passing!
My task accomplished and the long day done,
My wages taken, and in my heart
Some late lark singing,
Let me be gathered to the quiet west
The sundown splendid and serene,
Death. B.M.W.

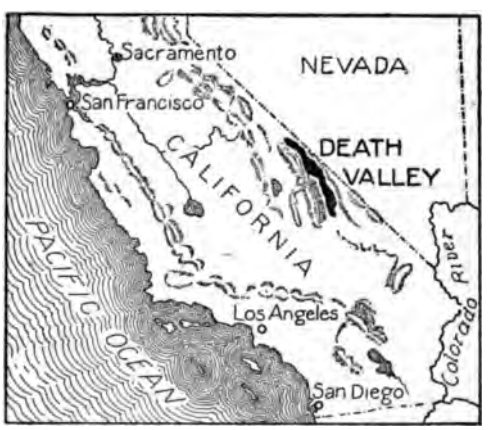
DEATH'S-HEAD MOTH, a moth of the interesting and beautiful family of sphinx moths, so named because of characteristic pale-yellow marks on the back of its thorax. The resemblance of these marks to a skull or death's head has given rise to many superstitious beliefs. The moth has a thick, hair-covered body, and wings that are strong, but soft and downy, and measure four or five inches across. The forewings are brown, spotted and marked; the hind ones are yellow, with two black bands. This beautiful night-flying creature often enters

DEATH'S-HEAD MOTH
This insect frequently grows to a size one-half larger than the illustration.

bee hives for honey. There its squeaking noise frightens the bees like the "voice" of the queen, so the moth is not killed or sealed up as are other robbers of hives.

The bright-yellow caterpillar of this moth, with its violet stripes and blue spots, feeds on leaves of potato and tomato plants, but does less harm than caterpillars of other species.

DEATH VALLEY, a sandy plain about fifty miles long and thirty-five miles wide, in Inyo County, Cal., close to the border of Nevada. The name was applied by a company of emigrants *en route* in 1849 to California's newly-



LOCATION OF DEATH VALLEY

discovered gold fields. Nearly all of this group of adventurers perished in the desert wastes. The plain is about 210 feet below the level of the sea and is destitute of vegetation, with the exception of cacti and greasewood. The

Panamint mountain range encloses it on the west and shuts out the Pacific winds. The Amargosa and Funeral mountains, suggesting its tragic story, constitute its eastern boundary, and volcanic ranges of a brown, yellow, black and red color make up the surrounding country.

These ranges furnish most of the borax used for commercial purposes (see BORAX). Summer heat rises frequently to 137° F., and on the mountain summits in the winter the thermometer often falls to 30° below zero. There is little animal life except the crow, buzzard, horned-toad, jackrabbit and rattlesnake. The wealth of the valley is purely mineral, quartz rich in gold having been found along the trail taken by the old emigrant parties, the "49-ers" referred to above. Silver, copper and lead have been found in paying quantities; and colemanite, taking its name from its discoverer, W. T. Coleman, has been found rich in borax. Human society in this valley consists principally of roving bands of Piute Indians and a few miners. Tourists should not attempt to cross this valley earlier than October nor later than April.

DEATHWATCH, a hard-bodied, red-brown beetle about a quarter of an inch long, which lives in the furniture and woodwork of houses. There, knocking its hard head on the wood to call to its mate, it produces the peculiar ticking sound which has caused superstitious people to believe that it is a sign of death. The larva (young) of a species of this beetle is the familiar, destructive bookworm (which see). A species of book-lice is also called deathwatch.

DEBATE. Chaucer, Spenser and other early English writers used the word *debate* in the sense of *fight* or *quarrel*, and Shakespeare in one passage speaks of men "debating with the sword"; but the term has now an entirely different meaning. While two speakers or sets of speakers who are formally discussing a question battle with words to prove their points and disprove those of their opponents, they are not disputing or quarreling; they are systematically arguing, and are making an appeal to reason, not to prejudice, sentiment or the emotions. They are *debating*.

Debate differs from the informal and formless discussion of public questions that is often heard around the dinner table or in places where people of leisure congregate, in that it is *organized argument*. The speakers are armed with facts on both sides of the question; they present their points in logical order; they are prepared beforehand to shatter the arguments brought up by the opposite side. The main purpose of a debate is to bring out the truth. A favorable decision won by trickery and not by strength of argument is a hollow victory.

Why Debating Is Beneficial. Participation in debates gives excellent training in self-control. The good debater must school himself to keep his temper and to overcome diffidence before an audience; he must forget himself and keep his mind on the points at issue. Debating trains one to meet emergencies promptly and to think quickly, and this in turn demands preparation. To meet an opponent's arguments a debater must have his knowledge systematized and his facts ready to be presented at a moment's notice. Those who become practiced in debate learn to express their ideas in clear and exact language; their judgment is trained, and their faculty for constructive thinking is developed. Not the least valuable of the results obtained from practice in debating is the ability it gives one to detect false and inconsistent reasoning. The mind schooled to think clearly and logically will not be misled by false arguments and misapplied facts.

What to Debate. Appropriate subjects for debate are to be found in every branch of human knowledge, but not all questions are debatable. A subject for debate must admit both of affirmation and denial; that is, it must not be all one-sided, nor so neutral that no decision can fairly be reached for one side or the other. The following is an example of a one-sided subject: *Resolved, That Shakespeare was a greater poet than Longfellow.* Shakespeare's supremacy is so obvious a fact that the negative side of this question could not well be sustained. Suppose the subject should read, *Resolved, That Shakespeare was a greater poet than Dante.* Here the opposite sides are too evenly balanced, for it is generally admitted that these two poets are practically equal in greatness. A subject should be stated so that the limits of the question will be exactly and clearly defined. If the subject for debate be the restriction of immigration, it should be definitely stated what immigrants are referred to. It is evident that a law which applies to the Chinese, for instance, could not fairly be applied to immigrants from Europe.

Proper Topics for Debate. Any topic for debate may be stated as a fact, as in the examples given above, or as a question. The following list contains subjects drawn from various fields, all of which are suitable:

1. Does the study of mathematics train the mind more effectively than the study of languages?
2. Is fiction more powerful than drama?
3. Is cultural education of more value to the average person than industrial education?
4. Is coeducation in high schools desirable?
5. Is too much emphasis placed on college athletics?
6. Does poverty develop character more than riches?
7. Is the press more influential than the pulpit?
8. Should the moving picture theater be encouraged?
9. Has heredity more influence upon character than environment?
10. Is city life of greater benefit to the individual than country life?
11. Is compulsory arbitration of labor disputes wise and feasible?
12. Are labor unions beneficial to the working classes?
13. Should wages of women be lower than those of men performing the same service in the same occupations?
14. Is the recall of public officials an influence for good in political life?
15. Is state [or provincial] prohibition preferable to local option in dealing with the liquor problem?
16. Should vivisection be prohibited by law?
17. Should women be granted the same political rights as men?
18. Should a nation maintain a large standing army?
19. Is the maintenance of large standing armies and big navies injurious to the advancement of world-wide peace?
20. Was President Wilson justified in refusing to recognize Huerta's government in Mexico?

A debate is always opened by the first speaker for the *affirmative* side, who states the question clearly and then presents his arguments. The first speaker for the *negative*, who follows, seeks to refute the arguments of the previous speaker, and he also advances arguments of his own. He is followed by the second speaker for the affirmative, and so on, until all have presented their points. Finally, the first debater is given a few moments for closing arguments.

A Debate Outlined. A topic of present-day interest and one which is suitable for school debating societies is here submitted, together with the arguments for the affirmative and negative sides of the question:

Resolved, That the organization and maintenance of labor unions should be encouraged.

AFFIRMATIVE	NEGATIVE
1. Labor unions are favorable to the interest of the working classes and protect them in their rights. Workmen who are not united are at a disadvantage in dealing with employers, for the latter are combined, and they have control of capital and machinery, and therefore of industry. By acting in unison members of labor unions can demand and secure better wages and shorter hours, they can maintain their wages in times of financial depression, and they can use their influence to secure laws that favor labor.	1. Labor unions are detrimental to the members because they place all men on a common level, regardless of ability. Individual advancement is prevented because the output of each member is limited. Individual liberty is restricted because men are forced to join the unions, they are denied the right to work where they wish, and are forced to go on strikes even when it is contrary to their judgment.
2. Labor unions are advantageous to employers. Business relations have been simplified by means of agreements as to hours of labor, wages and conditions of employment. Competent employees may always be obtained by applying to local unions.	2. Labor unions are injurious to the employer. They restrict his rights as an individual by dictating whom he shall employ or discharge. They infringe upon his right to buy material by placing boycotts on products of non-union labor. In times of labor disputes they infringe upon his rights as a property owner.
3. Labor unions promote the welfare of society. Dignified labor conventions have taken the place of disorderly and unorganized meetings of workmen. Foreign laborers through the unions have become Americanized and been made useful members of society. They encourage thrift and economy; their members are insured against death, sickness and unemployment, relieving society of a great burden. The character of the workmen is elevated through the sentiment of mutual assistance and support, and rules against idleness and vice.	3. Labor unions are detrimental to the public welfare because they place their own interests above those of the public by interfering with the operation of street cars, railroads and other public utilities, during strikes. Standards of citizenship are lowered by their disregard of law and order at such times. By ordering sympathetic strikes without just cause they bring about industrial depression and disturbances, and economic loss.
4. Methods adopted by labor unions are justified because, like other organized bodies, they restrict the liberty only so far as it is necessary to bring about the desired end, which in this case is the betterment of labor conditions. They do not arbitrarily fix a uniform wage rate, but a minimum rate, and they leave the question of higher pay for better service open for adjustment by the individual. Unions do not interfere with the rights of non-union men to work when and where they please, but union men are justified in refusing to work with non-union men because: The unions expend a great amount of time, trouble and money to bring about more favorable labor conditions, and it is not fair for non-union men to share benefits without sharing the burdens.	4. Labor unions are wrong in principle because they aim to accomplish a legal object in an illegal manner; that is, by ordering strikes which result in loss of life and destruction of property, by demanding the discharge or non-employment of non-union men, and by violating the fundamental rights of personal liberty. Labor unions are monopolies contrary to public policy and should be condemned.

DEBORAH, *deb'o ra,* a prophetess of Israel during the period of the Judges. Women, in all the world's history, in pointing to others of their sex who have accomplished notable things and have shown themselves capable in public affairs, never fail to mention Deborah. She was known as a "mother in Israel." In a campaign to deliver Israel from the Canaanites, whose yoke had been endured for twenty years, she joined Barak, the leader of the northern tribes of Israel, and together they destroyed the army of the Canaanites in the "plain of Esdraelon on the brook Kishon." The Canaanite leader, Sisera, fled and was murdered in his sleep by Jael, wife of Heber the Kenite. Then "the land had rest for forty years." *Judges* V gives the Song of Deborah, telling of joy over the nation's deliverance, and is considered one of the finest poems in the Old Testament.

DEBS, EUGENE VICTOR (1855-), a leading American Socialist, who has several times been a candidate for President of the United States on the Socialist ticket, and who is known to hundreds of thousands of Americans as an advocate of the rights of laboring men. He was born in Terre Haute, Ind., was educated in the common schools and began life as a locomotive fireman on the Terre Haute & Indianapolis Railroad. He next sold groceries for a wholesale house.

EUGENE V. DEBS

From 1879 to 1883 he held office as city clerk of Terre Haute, and in 1885 entered the Indiana legislature. Eight years later Debs organized the American Railway Union, which under his leadership won an important strike on the Great Northern Railway in 1894.

He was also the prime mover in the great tie-up of Western railroads centering in Chicago in 1894, which was broken by the interference of the Federal courts and by the vigorous measures of President Cleveland. In July of that year he was arrested on a charge of violating a Federal injunction in connection with the strike, and was sentenced to six months in jail. While he was serving his term he was visited by a Socialist leader and given various Socialistic works to read. From that period dates his activity as a member of the Socialist party in the United States, which chose him as its Presidential candidate in 1904, 1908 and 1912.

DEBT, *det,* is that which is due; more strictly, it is a sum of money due from one person to another. Originally the law regarded as a debt only those claims based on a definite, expressed agreement. This narrow view has long been abandoned, and a debt is now regarded as "all that is due a man under any form of obligation or promise." A debt, therefore, may be created by a special contract or by an ordinary business transaction.

If the debtor—the person who owes money—is unwilling or unable to pay the debt, the creditor may bring suit to recover his money. This is a *civil suit* (a suit of one citizen against another), and ordinarily results in a *judgment* in favor of the plaintiff, and the debtor usually has to pay the costs of the suit. If the court decides that the defendant does not really owe the alleged debt, the costs must be paid by the plaintiff. If the debtor fails to pay after judgment has been rendered against him, the creditor may appeal to the sheriff for an *execution* of judgment, and may seize enough of the debtor's property to pay the debt and the costs of the process. In all states and provinces some of the debtor's property is exempt from seizure; this exemption ranges from a house and lot owned by the debtor and used as a homestead, to a small amount of personal property, if the debtor be married; the exemption in such case usually is not more than $400 in value.

Statute of Limitations. Ordinarily the courts assert that a debtor should pay his debts even though the creditor does not demand payment. The obligation rests on the debtor. On the other hand, if the creditor makes no effort to collect the money within a certain number of years, the debt is said to be *outlawed* by the *statute of limitations.* If a creditor makes no effort to obtain payment within a reasonable time, the law assumes that there may have been a good reason for not doing so and gives the debtor the benefit of the doubt by relieving him of the debt. The tables on page 1725 show the number of years a debt may run in the United States and Canada before it is outlawed.

Imprisonment for Debt and Other Penalties. The laws regarding debtors have changed greatly with the progress of the ages. In

IN THE UNITED STATES

States and Territories	Statutes of Limitations: Judgments, Years	Notes, Years	Open Accounts Years	States and Territories	Statutes of Limitations: Judgments, Years	Notes, Years	Open Accounts Years
Alabama	20	6	3	Montana	10	8	5
Alaska	10	6	6	Nebraska	5	5	2
Arkansas	10	5	3	Nevada	6	6	4
Arizona	4	4	3	New Hampshire	20	6	6
California	5	4	4	New Jersey	20	6	6
Colorado	20	6	6	New Mexico	7	6	4
Connecticut	(g)	6	6	New York	20 (f)	6	6 ▲▲
Delaware	10 (e)	6	3	North Carolina	10	3 *	3
District of Columbia	12	3	3	North Dakota	10	6	6
Florida	20	5	3	Ohio	5	15	6
Georgia	7	20	6	Oklahoma	5	5	3
Hawaii	20	6	6	Oregon	10	6	6
Idaho	6	5	4	Pennsylvania	5 (d)	6 †	6
Illinois	20	10	5	Porto Rico	5	3	3
Indiana	20	10	6	Rhode Island	20	6	6
Iowa	(c)	10	5	South Carolina	10	6	6
Kansas	5	5	3	South Dakota	20	6	6
Kentucky	15	15	2	Tennessee	10	6	3
Louisiana	10	5	3	Texas	10	4	2
Maine	20	6	6	Utah	8	6	4
Maryland	12	3	3	Vermont	8	6	6
Massachusetts	6 (b)	6	6	Virginia	20	5 *	5
Michigan	6	6	6	Washington	6	6	3
Minnesota	10	6	6	West Virginia	10	10	5
Mississippi	7	6	3	Wisconsin	20 (a)	6	6
Missouri	10	10	5	Wyoming	21	10	8

* Under seal, 10 years. † Under seal, 20 years. ▲▲ Six years from last item. (a) Justice Court judgments, 6 years. (b) Witnessed, 20 years. (c) Twenty years from time when new suit may be brought, which is 15 years after first judgment. (d) Ceases to be a lien after the period unless revived. (e) Subject to renewal. (f) Not of record, 6 years. (g) No limit.

ancient times the debtor was handed over to the not usually tender mercy of his creditors; in Greece, in Rome, among the Jews and even in England under the Saxons, the debtor became in name and in fact the slave of his creditors. During the Middle Ages the man who was unable to pay his debts received more leniency. Every man was primarily a soldier, and his services were at the call of his overlord. In such a system it was impossible to allow imprisonment for debt to break up an army. As the feudal system declined and trade and industry became more important, the debtor was again subjected to harsh treatment. The uncertainties of business made it necessary to keep a strong check on debtors, and imprisonment was the usual penalty for delinquent debtors. Imprisonment, however, seldom brought the creditor the money he wanted, and the debtor's prison gradually became recognized as a blot on the penal system.

IN CANADA (*Years*)

Provinces	Judgments	Notes	Open Acc'ts
Alberta	12	6	6
British Columbia	20	6	6
Manitoba	10	6	6
New Brunswick	20	6	6
Nova Scotia	20	6	6
Ontario	20	6	6
Prince Edward Island	20	6	6
Quebec	30	5	5
Saskatchewan	12	6	6
Yukon	12	6	6

Imprisonment for debt is still allowed in nearly all countries, including Great Britain, Canada and the United States, but only in such exceptional cases as involve fraud, false pretenses or other statute offenses. For ordinary debtors the terrors of prison are no more. The writings of Charles Dickens had an important part in teaching the English-speaking world the horrors and the uselessness of the debtor's prison. Imprisonment for debt, with a few exceptions, was abolished in France in 1867, in England in 1869, in Belgium in 1871, in Ireland in 1872, in Switzerland in 1874, and in many other countries since then. In the United States such imprisonment has been abolished by the statutes of the individual states. (See BANKRUPTCY, which is a remedy both for debtors and for creditors.)

Debt, National. See NATIONAL DEBT.

DECALOGUE, *dek'a lahg,* the TEN COMMANDMENTS, comprising the whole moral law, which, according to the Old Testament, were "written with the finger of God" on two tables of stone and given to Moses on Mount Sinai. The text and application of all versions are practically the same, but the division varies in

different churches. For example, the Roman Catholic arrangement combines the first and second commandments and divides the tenth into two. The Hebrews called these precepts the "ten words." The Greeks adopted the name, for the Greek *deca* means *ten,* and *logos,* a word.

DECATUR, *de ka'tur,* ILL., named for Commodore Decatur, is the county seat of Macon County, situated in the central part of the state, thirty-eight miles east of Springfield and 173 miles southwest of Chicago. It is on the Sangamon River and on the Wabash, the Illinois Central, the Cincinnati, Hamilton & Dayton and the Vandalia railroads. The Illinois Traction System operates electric service to Springfield, Peoria, Bloomington, Champaign and other cities. In 1910 the population was 31,140; in 1916 it was estimated at 39,631. The area is over six square miles.

The city has Fairview, Lincoln, Nelson and Torrence parks, a Carnegie Library, a hospital and a home for the aged and orphans. Decatur is the seat of James Millikin University (Presbyterian), a coeducational school founded in 1901. Excellent railroad accommodations have given Decatur a large trade in the produce of the surrounding agricultural country and coal from mines in the vicinity. The important industrial plants are manufactories of iron products, plumbing supplies, water-works equipment, electric-light fixtures, soda fountains, corn shellers, hominy, corn meal, corn flour and starch.

Decatur was settled in 1830 and was incorporated in 1836. The commission form of government was adopted in 1911. The water works and electric light plant are owned and operated by the city. The organization of the Grand Army of the Republic originated at Decatur with the creation of Post 1 on April 6, 1866.

DECATUR, STEPHEN (1779-1820), one of the most daring officers in the American navy during the early period of United States history. In 1798 he enlisted as midshipman, was promoted to the rank of lieutenant the following year, and in 1803, during the war with Tripoli, took command of the *Enterprise,* which was then a part of the Mediterranean squadron. On the night of February 16, 1804, Decatur took a small vessel, the *Intrepid,* with a picked band of Americans, into the harbor of Tripoli, set fire to the frigate *Philadelphia,* which had been captured by Tripolitan pirates, and under a fierce fire from the enemy's batteries made way back to the fleet, stationed at Syracuse; not a man was killed and only one was wounded. This act, pronounced by the English Admiral Nelson to be the "most daring of the age," won him a sword of honor and appointment as captain.

STEPHEN DECATUR

Early in the War of 1812, while commanding the *United States,* he captured the British frigate *Macedonian,* after a desperate struggle. In 1813 he was given the honorary title of commodore and placed in command of a squadron in New York harbor. In January, 1815, while attempting to run the British blockade, his flagship, the *President,* struck on the bar at Sandy Hook and became disabled. Decatur, forced into a fight against heavy odds, was finally compelled to strike his colors and was taken a captive to Bermuda.

He was soon paroled, and in the same year took command of the operations against Algiers, Tunis and Tripoli, forcing those countries to respect the rights of other nations on the Mediterranean (see BARBARY STATES). On his return to the United States he was made navy commissioner, and held this office until his death, which occurred in a duel with Commodore James Barron. Particularly famous is Decatur's "toast":

"Our country! In her intercourse with foreign nations may she always be in the right; but, our country, right or wrong."

DECCAN, *dek'an,* a name which is somewhat variously applied to the great peninsula of India. In a general sense it includes the whole of Hindustan south of the Nerbudda River; in another sense it is restricted to the region lying between the Nerbudda and Kistna rivers. The British government considers it as within the larger limits and makes it include the great Madras and Bombay presidencies and several native states. The region is a vast plain, 700 miles long and 800 miles at its greatest width. Two ranges of mountains run along the coasts, known as the Eastern and Western Ghats. The Deccan contains the densest population in the world. See INDIA.

DECEMBER, the twelfth and last month of the year, often represented pictorially by a very old and feeble Father Time, leaning on a staff. The *decem* of its name, so familiar to even the beginning Latin student, seems strange as applied to this month, for it means *ten;* but in the old Roman days, before the reform of the calendar, December was the tenth month. By the time the change was made the numerical significance of its name had been somewhat lost sight of; at any rate, no learned Roman thought it of enough importance to call for correction. One alteration occurred, however; for centuries December had had but twenty-nine days, but Caesar added two, making it one of the longest months. The holly is the special flower of this month, and its gem is the turquoise. See CALENDAR.

December's Place in the Year. The first of December is generally considered to begin the winter season, but in reality winter does not commence until December 22, the day on which the sun reaches the solstice (see SOLSTICE) and turns back for its northward journey. In the northern hemisphere that is the shortest day of the year, in the southern hemisphere, the longest, though for a month thereafter there is little perceptible change in the length of the days. Though December is frequently spoken of as the "frosty month" or the "icy month," it is not usually the coldest of the winter months, nor is it the most cheerless, for the good will, the crackling fires and the holly of approaching Christmas seem to shed a glow over all. The Romans made Vesta, goddess of the hearth, the special deity of December, and this seems appropriate, for there is no time when hearth fires are more in evidence or when they have a greater significance.

The great Christian festival of Christmas (which see), celebrated on the twenty-fifth, is the chief holiday of the month; indeed, to the children at least, it is the chief holiday of the year. The thirty-first, the last day of the year, is known as New Year's Eve, and often partakes of the festivities with which the opening of the new year is celebrated. New England has set apart the twenty-first for special reverence, and calls it Forefathers' Day. On that day the Pilgrims, that "band of exiles," "moored their bark on the wild New England shore" and began to make history that yet influences the entire country.

December Out-of-Doors. This is one of the months in which Nature seems to be resting, for of the manifold activities of summer and autumn there remains scarcely a trace. This does not mean that the month has no interesting out-of-door phases. There are the hardy evergreen trees and the holly—how are they able to live and be so cheerful when the other plants seem practically dead? Why has not the cold driven away the English sparrows and the chickadees, with most of the other birds? There are wonderful "Jack Frost" traceries to be studied on the windows (see FROST), and beautiful snow crystals to be examined under the microscope, and there are all the strange achievements of the cold. Why is not the ice in the brook as rippled as is the water in summer time? Since cold contracts, why does the frozen milk push its way up out of the bottle, and why does freezing water crack a pitcher? The child can do no better than to interest himself in such studies as these in this winter month, for it is even more necessary than in the summer that he should have plenty of out-of-door air, since homes are not likely to be as well ventilated as in the open-door and open-window season. A.MC C.

DECEMBER CALENDAR

Birthdays

3. Gilbert Stuart, 1755
   George B. McClellan, 1826
4. Thomas Carlyle, 1795
5. Martin Van Buren, 1782
   George A. Custer, 1839
6. John S. Mosby, 1833
7. Mary, Queen of Scots, 1542
8. Eli Whitney, 1765
   Henry Timrod, 1829
   Joel Chandler Harris, 1848
9. John Milton, 1608
10. William Lloyd Garrison, 1805
    Edward Eggleston, 1837
12. John Jay, 1745
    John S. Macdonald, 1812
13. Phillips Brooks, 1835
14. Tycho Brahe, 1546
    Sir Francis Hincks, 1807
15. George Romney, 1734
16. Jane Austen, 1775
17. Ludwig von Beethoven, 1770
    Sir Humphry Davy, 1778
    John Greenleaf Whittier, 1807
18. Lyman Abbott, 1835
    Edward A. MacDowell, 1861
19. Gustavus Adolphus, 1594
    Edwin M. Stanton, 1814
20. Cyrus Townsend Brady, 1861
21. Thomas à Becket, 1117
    Benjamin Disraeli, 1804
22. James E. Oglethorpe, 1696
24. Christopher ("Kit") Carson, 1809
25. Sir Isaac Newton, 1642
    Clara Barton, 1821
26. Thomas Gray, 1716
27. Johann Kepler, 1571
    Sir Mackenzie Bowell, 1823
28. Woodrow Wilson, 1856
29. William E. Gladstone, 1809

Events

1. Hudson's Bay Company transferred government rights to the Dominion, 1869
2. Napoleon crowned emperor of France, 1804
   Battle of Austerlitz, 1805
   Monroe Doctrine advanced in President Monroe's message to Congress, 1823
   Austrians occupied Belgrade, 1914
3. Battle of Hohenlinden, 1800
   Illinois admitted to the Union, 1818
5. England established uniform postal rate for letters, 1839
   Rome was made the capital of Italy, 1870
6. Columbus discovered Haiti, which he named Hispaniola, 1492
   Jefferson Davis died, 1888
   German forces captured Bucharest, capital of Rumania, 1916
7. Cicero assassinated, 43 B. C.
8. Americans began siege of Quebec, 1775
   Chinese adopted Roman calendar, 1911
   British won naval victory off Falkland Islands, 1914
9. Confederation formed by Australian colonies, except New Zealand and New South Wales, 1885
10. Mississippi admitted to the Union, 1817
    Sherman's army took Savannah, Georgia, 1864
    Wyoming women authorized to vote and hold office, 1877
11. Indiana admitted to the Union, 1816
12. Fort George, in Canada, abandoned by the United States, 1812
    Sherman's army completed its march to the sea, 1864
    Japanese invaded Korea, 1894
    Delhi made capital of India, 1911
13. Sir Francis Drake left England to sail around the world, 1577
    Federals defeated at Fredericksburg, 1862
14. Alabama admitted to the Union, 1819
15. Hartford Convention assembled, 1814
    Alabama Claims Commission convened at Geneva, Switzerland, 1871
16. Oliver Cromwell declared Lord Protector for life, 1653
    "Boston Tea Party," 1773
17. Milan Decree issued, 1807
18. Russian squadron entered Port Arthur, 1897
    Egypt proclaimed a British protectorate, 1914
20. Texas declared itself independent of Mexico, 1835
21. Pilgrims landed at Plymouth, Massachusetts, 1620
22. Chino-Japanese treaty signed, 1905
24. Methodist Episcopal Church in America organized, 1784
    Treaty of Ghent signed, 1814
25. Washington and his men crossed the Delaware, 1776
26. Battle of Trenton, 1776
28. Spain recognized Mexican independence, 1836
    Iowa admitted to the Union, 1846
    Women given permission to practice in law courts of Canada, 1892
29. Thomas à Becket assassinated, 1170
    Texas admitted to the Union, 1845
    First American Y. M. C. A. established in Boston, 1851
30. Gadsden Purchase arranged, 1853
31. Palmetto flag of South Carolina raised over United States arsenal at Charleston, South Carolina, 1860

For Study

Chickadee
Christmas
Electricity
English Sparrow
Fir
Gas
Holly
Ice
Mistletoe
Nuts
Orange
Pop corn
Squirrel
Winter heavens (see ASTRONOMY)

DECEMBER QUOTATIONS

1. December drops no weak, relenting tear,
   By our fond summer sympathies ensnared,
   Nor from the perfect circle of the year
   Can even winter's crystal gems be spared. *Cranch.*

2. I hold it true with him who sings
   To one clear note in divers tones
   That men may rise on stepping-stones
   Of their dead selves to higher things.
   Tennyson.

3. Politeness has been well defined as benevolence in small things.
   Macaulay.

4. Literature is the thought of thinking souls. *Carlyle.*

5. Blow, blow, thou winter wind,
   Thou art not so unkind
   As man's ingratitude:
   Thy tooth is not so keen,
   Because thou art not seen,
   Although thy breath be rude.
   Shakespeare.

6. Theirs not to reason why,
   Theirs but to do and die. *Tennyson.*

7. The very perfection of manners is not to think about yourself. *Whately.*

8. All work, even cotton-spinning, is noble; work is alone noble. *Carlyle.*

9. Thousands at his bidding speed,
   And post o'er land and ocean without rest;
   They also serve who only stand and wait. *Milton.*

10. Our country is the world; our countrymen are mankind. *Garrison.*

11. The stars are glittering in the frosty sky,
    Numerous as pebbles on a broad sea-coast. *Heavysege.*

12. Nature does well whatever task she tries
    Because *obedient*—there the secret lies.
    Smith.

13. Good manners is the art of making those people easy with whom we converse. *Swift.*

14. The sweeping blast, the sky o'ercast,
    The joyless winter day,
    Let others fear; to me more dear
    Than all the pride of May. *Burns.*

15. Obedience is better than sacrifice, and to hearken than the fat of rams.
    Psalms.

16. Politeness is to do and say
    The kindest thing in the kindest way.

17. I know not where his islands lift
    Their fronded palms in air;
    I only know I cannot drift
    Beyond his love and care.
    Whittier.

18. When another speaks be attentive yourself and disturb not the audience. *Washington.*

19. A moral, sensible and well-bred man
    Will not affront me, and no other can.
    Cowper.

20. The soldier who executes his captain's commands is no less valuable than the captain who gives the order.
    Cervantes.

21. Wild was the sky; the wintry sea
    Moaned sadly on New England's strand,
    When first the thoughtful and the free,
    Our fathers, trod the desert land.
    Bryant.

22. Ay, call it holy ground,
    The soil where first they trod;
    They left unstained what there they found—
    Freedom to worship God. *Hemans.*

23. Obedience alone gives the right to command. *Emerson.*

24. But peaceful was the night
    Wherein the Prince of light
    His reign of peace upon the earth began. *Milton.*

25. I heard the bells on Christmas Day
    Their old, familiar carols play,
    And wild and sweet
    The words repeat
    Of peace on earth, good-will to men.
    Longfellow.

26. The boast of heraldry, the pomp of power,
    And all that beauty, all that wealth e'er gave,
    Await alike the inevitable hour—
    The paths of glory lead but to the grave. *Gray.*

27. Heap on more wood! — the wind is chill;
    But let it whistle as it will,
    We'll keep our Christmas merry still.
    Scott.

28. Let thy child's first lesson be obedience, and the second will be what thou wilt. *Franklin.*

29. To the cold December heaven
    Came the pale moon and the stars,
    As the yellow sun was sinking
    Behind the purple bars. *Shanly.*

30. Cap in hand never harmed anyone.
    Italian Proverb.

31. Good-bye, kind year; we walk no more together,
    But here in quiet happiness we part;
    And from thy wreath of faded fern and heather,
    I take some sprays, and wear them on my heart. *Doudney.*

DECEMVIRS, *de sem'verz,* a term which might be applied to any official body of ten men (from *decem,* meaning *ten*), but having specific reference to the ten magistrates appointed in 451 B.C., with absolute powers for one year, to systematize the laws of Rome. The first commission governed with wisdom and moderation, but its successors were extremely unpopular, their violence and despotism leading to an insurrection and the abolishment of the office in 449 B.C.

DECIDUOUS, *de sid'u us,* **TREES,** those trees which lose and renew all their leaves each year at definite seasons, as the oak, ash, beech, birch, elm and many others which are familiar to everyone. The term *deciduous* is from Latin words which mean *something which falls down.* In temperate countries most deciduous trees lose their leaves in the autumn, or fall of the year, leaving twigs and branches bare in winter; in the spring they don a new garb of green. In certain other countries the falling of the leaves is governed by times of drought, etc.

The falling of the leaves is caused by the formation of a waterproof layer of tissue where the leaf joins the twig, as a result of which the leaf is cut off from its source of supply. It then has a weaker hold on the twig and the winds loosen it. See LEAVES.

Those trees which have a covering of leaves all the year are called evergreens (see EVERGREEN).

DECIMAL FRACTIONS. Our system of writing numbers is a decimal system. (For a full discussion of this, see NOTATION.) Since a clear understanding of our decimal notation is essential to an intelligent attack upon decimal fractions, a short review of it is given here.

Place value is the idea underlying the system of notation. The number expressed by $\overset{abc}{222}$ is 200+20+2. The value of *b* is 10 times as great as that of *c;* the value of *a* is 10 times as great as that of *b.* A digit represents so many *ones,* or so many *tens,* or so many *hundreds,* and so on, according to the column, or "place," it occupies. Read the lettered digits, giving their full number values: $\overset{ab}{7886}$; *a* reads 800; *b* reads 80. *b* is ⅒ as large as *a.* In the expression $\overset{abc}{6444}$ *a* reads 400; *b* reads 40; [illegible]ds 4; *c* is ⅒ as great as *b; b* is ⅒ as [illegible] as *a.*

[illegible]h of this reading should precede the study of decimal fractions, and there should also be work such as the following: Read the underlined, giving full value: 7836; 9248; 4924; 73926. They read 800, 30; $\bar{9}000$, $\bar{4}0$; $\bar{4}000$, 4; $\bar{3}000$, 20.

Read, giving full value to each part, and write as you read, indicating this full value: 7936=7000+900+30+6. Write in column form:

$$\begin{array}{r} 7000 \\ 900 \\ 30 \\ 6 \\ \hline 7936 \end{array}$$

It took the human race about twelve centuries to take the step from writing *whole numbers* in a decimal system to writing *fractions* in the same system. The decimal fraction appeared in the sixteenth century, and it was not until the eighteenth that it was recognized in the schools. The nineteenth century brought it into somewhat general use, but the early twentieth century sees it supplanting generally the common fraction in the scientific and industrial world.

Let us examine the method of transition from the decimal notation applied to whole numbers, to the same applied to fractions. In the expression $\overset{abc}{111}$, *c* is ⅒ of *b; b* is ⅒ of *a.* It is desired to write a number which is ⅒ of *c.* Place 1 to the right of *c* and have $\overset{abcd}{1111}$; by this transaction the original number *111* is changed to *1111;* that is, *c* has changed from 1 to 10, and *b* from 10 to 100 and *a* from 100 to 1000. But we wish to write a number that is ⅒ of *c,* and not change the value of the original number *111.* How can it be done? In other words, how can we write 111⅒, using the decimal system employed in writing whole numbers? Here are several of the ways used in the sixteenth and seventeenth centuries:

$$111\underline{|1};\ 1111;\ \overset{01}{1111};\ 111\ \bar{1};\ 111\ \underline{1};$$
$$\underset{01}{}$$

and there were other methods. Below are given some illustrations of decimals, whole and fractional, as they appeared in the early days of decimal fractions:

$$7186\underline{|847};\ 7186\ \overset{123}{847};\ 7186\overline{847};\ 7186^{0}8^{1}4^{2}7^{3};$$

each reads seven thousand one hundred eighty-six and eight hundred forty-seven thousandths, although the early writers read the fractions at first 8-tenths, 4-hundredths, 7-thousandths.

This short historical review shows that the great difficulty of the men who first tried to write decimal fractions was to find a means of

distinguishing, or *separating*, the fraction from the whole number. Some sign of separation was needed. These more or less clumsy ways of designating that separation have given way to the comma and decimal point. Indeed, the decimal point was used by one writer in 1612, but was abandoned. The comma is used to-day in many countries of Europe. The United States uses the point. (Mathematicians are interested at present in having the countries agree on one separatrix, America, of course, hoping that the point will be adopted.) With the simple separatrix, the writing of decimal fractions becomes an easy matter. The beginner in decimal fractions writes 1.1, one and 1-tenth; 1.11, one, 1-tenth and 1-hundredth; 16.123, 16 and 1-tenth, 2-hundredths and 3-thousandths. The decimal fractions should be read to him and by him for some time in this way. He is asked to write 4 and 7-tenths and 8-hundredths, and he writes 4.78 and reads it as above; then he is asked to write 4 and 8-hundredths, and, finding he must fill the tenth's place with zero, he writes 4.08, and reads 4 and 8-hundredths. Gradually he reduces the fraction and reads 4 and 78-hundredths (see Fig. 1).

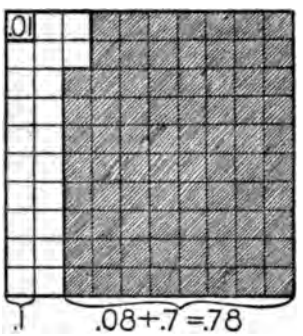


FIG. 1.
The shaded portion represents 78 units, each of which has the value .01; or, 7 units having the value .1, plus 8 having the value .01.

The necessity of this reduction is evident; .78 is 7-tenths and 8-hundredths, which reduced to hundredths gives 78-hundredths. Approaching it from the other side, 78-hundredths, reduced, gives 7-tenths and 8-hundredths.

Which is hundredth's place?
The second place.
Which is thousandth's place?
The third place.

These are the kinds of questions that should come to the beginner in decimal fractions; not "How many places for hundredths? for thousandths?" and so on.

After the reduction, the decimal fraction is read just as a common fraction; the number to the right of the decimal point is the numerator, and is read as a whole number, and the denominator is recognized from the last place occupied by the numerator; for example, .75 is read 75-hundredths, .094 is read 94-thousandths, 12.1854 is read 12 and 1854-ten-thousandths. These written as common fractions would appear:

$$\frac{75}{100},\ \frac{94}{1000},\ 12\frac{1854}{10000}$$

Reduction of Decimal Fractions. If .6 is to be considered in hundredths, the hundredth's place is filled with a zero and the fraction appears .60. If it is to be considered as thousandths, both hundredth's and thousandth's places are filled with zeros, and the fraction appears:

.600
.6 = .60 = .600

Six - tenths = sixty - hundredths = 600 - thousandths.

Other illustrations:

$$.75 = .750 \qquad \frac{75}{100} = \frac{750}{1000}$$

$$.500 = .50 = .5 \qquad \frac{500}{1000} = \frac{50}{100} = \frac{5}{10}$$

From this we see that (1) zeros annexed to a decimal fraction do not change its value, as .7=.70=.700, and (2) zeros may be dropped from the end of a decimal fraction and the value of the fraction remain the same, as, .700=.70=.7.

Addition and subtraction of decimal fractions hold nothing new for the child if he has appreciated the place value idea set forth above. He adds or subtracts just as in whole numbers; no time need be given to these. He sees that he needs the decimal point in the *answer* between units and tenths just as in the addends or above the line. He knows that "the points must come under each other" so that tenths are all in the same "place," or column, hundredths all in the same place, etc. So, without preliminaries he adds or subtracts as follows, just as in whole numbers:

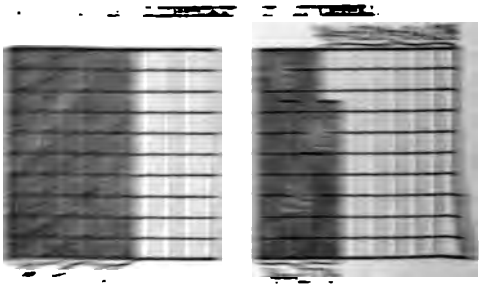
$$\begin{array}{r} 7.8 \\ 16.48 \\ 12.096 \\ \hline 36.376 \end{array} \qquad \begin{array}{r} 14.693 \\ -\ 8.452 \\ \hline 6.241 \end{array}$$

$$\begin{array}{r} 124 - 16.943 = n \\ 124.000 \\ -\ 16.943 \\ \hline 107.057 \end{array}$$

$$\begin{array}{rr} 7.8 & 7.800 \\ 4.586 = & 4.586 \\ 19.81 & 19.810 \\ & \hline & 32.196 \end{array}$$

The numbers to be added or subtracted may be reduced to the same denomination as in the last two problems above, by filling the places with zeros.

After the child has worked a day or two



$$\frac{9}{50}=\frac{9.00}{50}=.18$$
$$\frac{17}{80}=\frac{17.0000}{80}=.2125$$
$$\frac{2}{3}=\frac{2.0000}{3}=.6666+$$

Then follows the common fraction that cannot reduce to a decimal fraction without having a fraction in the numerator of the decimal:

$$\frac{1}{3}=\frac{1.0}{3}=.3\frac{1}{3}$$
$$\frac{5}{6}=\frac{5.00}{6}=.83\frac{1}{3}$$
$$\frac{5}{6}=\frac{5.0000}{6}=.8333\frac{1}{3}$$

There are two points of interest here:

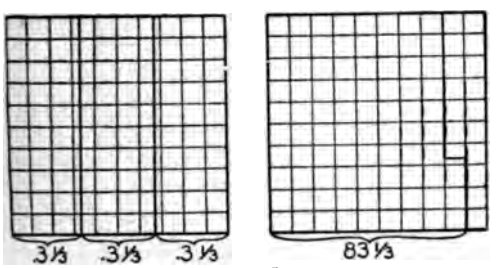


FIG. 5

(1) In $.3\frac{1}{3}$, $\frac{1}{3}$ is $\frac{1}{3}$ of a tenth (Fig. 5)

In $.83\frac{1}{3}$, $\frac{1}{3}$ is $\frac{1}{3}$ of a hundredth

In $.8333\frac{1}{3}$, $\frac{1}{3}$ is $\frac{1}{3}$ of a ten-thousandth

(2) When shall one drop the fraction? This depends upon the real problem that gives rise to the fraction, and *only the conditions of that problem can determine when the fraction may be discarded.* This depends upon the value of the material and the degree of accuracy desired. Is it a fraction of a pound of coal or of a gram of radium? Is the answer required a rough estimate or a refined exactness? But for practice in abstract numbers the class may carry to two places at one time, three places another time, and so on. These points determine when the fraction may be dropped.

Multiplication of Decimals. Moving the decimal point changes the place of the digits that express a number, and therefore changes the value of the number; for example, 67.3. Here 6 represents 60, 7 is 7 ones, 3 is 3-tenths. Move the point one place to the right, 673.; 6 becomes 600, 7 becomes 70 and 3 becomes 3 ones, making the number 10 times what it was before. Move the point one place to the left, and have 6.73; 6 becomes 6 ones, 7 becomes 7-tenths and 3 becomes 3-hundredths, which makes the number $\frac{1}{10}$ what it was at first. So we see that moving the decimal point one place to the right multiplies the number by 10, and moving it one place to the left divides the number by 10.

Multiply the following by moving the point one place to the right, and we have:

7.6	76.
4.16	41.6
17.09	170.9
6.004	60.04

Divide the following by 10 by moving the point one place to the left, and we have:

8.6	.86
12.07	1.207
.18	.018

It is easily seen from the above discussion that moving the point two places to the right multiplies, and two places to the left divides, the number by 100. This can be seen for any number of places when the effect of moving one place is clear.

Multiplier changes:

(1) $424\times142=60208$
(2) $424\times14.2=n$

How does the second multiplier compare with the first? It is $\frac{1}{10}$ as great; therefore the second product is $\frac{1}{10}$ as great as the first. We find a number $\frac{1}{10}$ as great as 60208 by moving the decimal point one place to the left. So (2) above becomes $424\times14.2=6020.8$.

(3) $424\times1.42=n$

How does the third multiplier compare with the second? It is $\frac{1}{10}$ as great; therefore the third product will be $\frac{1}{10}$ as great as the second product. This number we get by moving the point in the second product one place to the left, and we have $424\times1.42=602.08$. Now let us look at the three together:

$$424\times142=60208$$
$$424\times14.2=6020.8$$
$$424\times1.42=602.08$$

We see that when the *multiplicands are the same* and the *multiplier changes,* the *product changes in the same proportion as the multiplier.*

The same thing can be shown where the multipliers are the same and the multiplicand changes, as:

$$424\times142=60208$$
$$42.4\times142=6020.8$$
$$4.24\times142=602.08$$

The second product is $\frac{1}{10}$ of the first, and the third is $\frac{1}{10}$ of the second, because in each case the multiplicand is $\frac{1}{10}$ as great as the preceding one and the multiplier is the same as the preceding multiplier. Here the product changes as the multiplicand changes.

Multiplicand and multiplier change:

$424 \times 142 = 60208$
$424 \times 14.2 = 6020.8$
$42.4 \times 14.2 = 602.08$
$42.4 \times 1.42 = 60.208$
$4.24 \times 1.42 = 6.0208$

From this it is seen that the product varies in value as the multiplicand and multiplier together vary, that for each division of either multiplicand and multiplier by 10 the product is divided by 10; put in the common language of arithmetic, "The product contains as many decimal places as the multiplicand and the multiplier together." (See Fig. 6.)

If (5) $n \times .08 = .0056$, $n = .07$. Why? Because the number of decimal places in n added to the number in .08 makes 4, the number in .0056, the product.

Express the same problems in division:

(2) $5.6 \div 7 = n$ (n stands for the quotient)
(3) $.56 \div 7 = n$
(4) $.056 \div .7 = n$
(5) $.0056 \div .07 = n$

One sees how many decimal places there are in n each time by seeing what number of decimal places must be added to the number of decimal places in the divisor to make the number of decimal places in the dividend (or, in other words, he sees the *dividend* as a *product*). This attack upon division of decimals makes it a very simple piece of work. The dividend is a product; therefore, it contains as many decimal places as the two terms, namely, divisor and quotient, that produce it. Expressed as a rule:

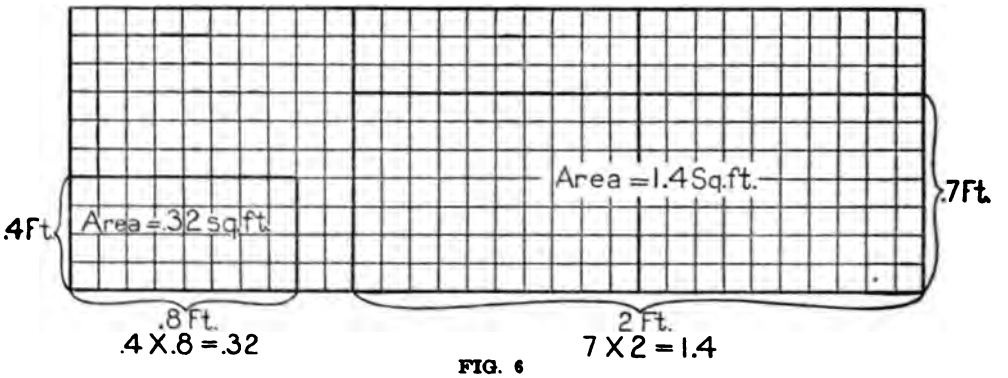


FIG. 6

The formal rule is: *Multiply as in whole numbers; point off in the product as many decimal places as there are decimal places in the multiplicand and the multiplier.*

Division of Decimals. This follows directly from multiplication; with two points clear in mind division of decimals presents no new difficulty. These points are:

(1) A dividend is the product of the divisor and quotient.

(2) A product contains as many decimal places as the multiplicand and multiplier together contain. That is, (1) $7 \times 8 = 56$, and (2) $7 \times n = 5.6$.

Number (2) above says, "What number multiplied by 7 gives the product 5.6?" From the work we have done in multiplication of decimals we know that the missing number must have one decimal place because the product has one; now the other term, 7, has none, and therefore $n = .8$. In this statement (3), $7 \times n = .56$, the product has two decimal places, and the given number, 7, has none; so n must have two, and $n = .08$.

In (4), $.7 \times n = .056$, the product has three decimal places and the given number, .7, has one decimal place; therefore n must have two decimal places and $n = .08$.

Divide as in whole numbers, and point off as many decimal places in the quotient as added to the number of decimal places in the divisor will give the number of decimal places in the dividend.

One special case must be considered under this that often gives much trouble; namely, where the dividend does not have so many decimal places as the divisor. Since the dividend is the product of divisor and quotient, it must have at least as many places as one of those terms. For example, put into multiplication form, $15 \div .75 = n$; $15 = .75 \times n$. When .75 and n were used to give a product, that product must have had at least two decimal places; therefore 15 in its present form could not have come from such multiplication; it must have been 15.00 or have had more decimal zeros. The division problem now is:

$15.00 \div .75 = n$
$n = 20$

Proof:
.75
20
15.00

The proof shows clearly that 15.00, and not 15, was the form of the product; and that form must be restored so that we may divide.

Let us look at it first from the view of multiplication, and then division:

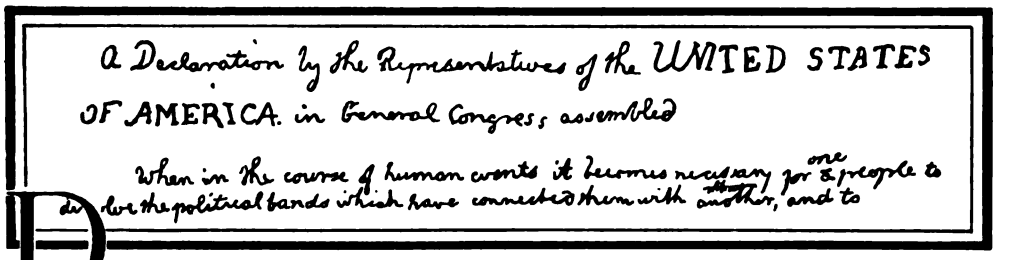
$$\begin{array}{r} 144 \\ .25 \\ \hline 720 \\ 288 \\ \hline 36.00 \end{array} \qquad 36 \div .25 = n$$

Restore the two zeros that we discarded, and we have $36.00 \div .25 = 144$.

To sum up: When a product ends in decimal zeros, these zeros may be cut off, but when this product is brought to view again as a dividend, the discarded zeros must be restored before division is performed. In the language of arithmetic: *The dividend must have at least as many decimal places as the divisor before we begin to divide, and if it has not, we must add the required number of decimal zeros.* For example:

$18 \div .006 = 18.000 \div .006 = 3000$
$1.8 \div .006 = 1.800 \div .006 = 300$
$.18 \div .006 = .180 \div .006 = 30$
$225 \div .15 = 225.00 \div .15 = 1500.$
$7000 \div 1.4 = 7000.0 \div 1.4 = 5000$

A.H.



DECLARA'TION OF INDEPEND'ENCE, a famous historic document, which, adopted by the Continental Congress on July 4, 1776, proclaimed to the world the independence of the thirteen colonies of Great Britain in America, and marked the birth of a new nation. When this Declaration was passed, actual warfare to drive out the forces of the mother country had already begun. The battles of Lexington and Concord and of Bunker Hill had been fought, Ticonderoga and Crown Point had been wrested from the British, Washington had been appointed commander-in-chief of the army, and the last futile petition had been sent to King George III. The spirit of independence was abroad.

Lee's Memorable Resolution. Early in 1776, several delegates to Congress, which was in session in Philadelphia, were instructed by the patriots whom they represented to vote for a formal statement of independence, and Massachusetts, New Hampshire and South Carolina had previously set up independent colonial governments. On May 15 Congress adopted a resolution advising all the other colonies to follow the example of the three, and the way was therefore paved for the famous resolution of Richard Henry Lee of Virginia, who moved on June 7:

That these United Colonies are, and of right ought to be, free and independent States; that they are absolved from all allegiance to the British Crown, and that all political connection between them and the State of Great Britain is, and ought to be, totally dissolved;

That it is expedient forthwith to take the most effectual measures for forming foreign alliances;

That a plan of confederation be prepared and transmitted to the respective colonies for their consideration and approbation.

These motions were at once seconded by John Adams of Massachusetts, and were debated on June 8 and 10, but action thereon was postponed until all the colonies could act.

The Committee on Declaration. On June 10 a committee was appointed "to prepare a Declaration to the effect of the first said resolution." On this committee were some of the most illustrious men of the period—Thomas Jefferson, its chairman, and his four able assistants, John Adams, Benjamin Franklin, Roger Sherman and Robert R. Livingston. The committee made its report on June 28.

The Final Steps. On July 1 the consideration of Lee's resolution was renewed, Congress forming itself into a committee of the whole and sitting with closed doors while the great debate was in progress. John Adams delivered a speech in favor of the resolution which was so effective that Thomas Jefferson afterward called him the "Colossus of that debate." The next day Lee's motion was formally adopted,

The illustration with the heading of this article is a *facsimile* of the first lines of the original Declaration, as written by Thomas Jefferson.

on July 3 the Declaration, which was drafted by Jefferson, was taken up, and on July 4 it was passed and published to the people. The delegates from twelve colonies gave their approval at this time, New York adding its vote on July 9. In its final form the Declaration is shorter than reported by the committee, as several amendments were made before the final vote was taken.

WHERE THE DECLARATION WAS WRITTEN

House in Philadelphia in which Jefferson and his associates framed the document.

The news of the adoption of the Declaration of Independence brought rejoicing to all parts of the country, and the famous Liberty Bell in Independence Hall was rung as never before, for Fourth of July of 1776 gave new meaning to the legend engraved upon it—"Proclaim liberty to all the land and to the inhabitants thereof" (see LIBERTY BELL). The original document is now in the care of the State Department, sealed in a steel case to protect it from light and air, and preserved with the nation's other priceless relics. B.M.W.

DECLENSION, *de klen'shun.* When the different forms of any noun or pronoun are arranged in their order in the three cases and both numbers, we are said to *decline* it, or to give its *declension.* Thus, declension is to nouns and pronouns what conjugation is to verbs and comparison to adjectives; that is to say, it is a form of inflection, or the systematic arrangement of changes in form. The noun *man,* the personal pronoun *he,* and the relative pronoun *who* are declined above as types.

	SINGULAR	PLURAL	SINGULAR	PLURAL	SINGULAR AND PLURAL
Nom.	man	men	he	they	who
Poss.	man's	men's	his	their	whose
Obj.	man	men	him	them	whom

Among the interrogative and relative pronouns, *who* (with its compounds *whoever* and *whosoever*) is the only one that is declined, for *which, what* and *that* have the same form in both the nominative and objective cases, singular and plural, and are not used in the possessive case.

DECLINATION, *dek li na'shun.* See ASCENSION AND DECLINATION OF STARS.

DECOMPOSITION, *de kom po zish'un,* in chemistry, is the process of separating compound substances into the substances of which they are composed—in other words, the process of converting one substance into two or more substances. Thus, water may be decomposed into hydrogen and oxygen, and limestone may be decomposed into lime and carbon dioxide. The term *decomposition* is most commonly applied to the separation of compounds due to natural causes, such as the decomposition of dead vegetable and animal matter under the action of micro-organisms. Such decomposition, or *decay,* is aided by moderate heat and by moisture (see BACTERIA; MOLDS).

Dry substances will not decompose, and a low temperature retards or stops decomposition. Heating for a time to the temperature of boiling water will kill the micro-organisms and so preserve the vegetable or animal matter. These methods are all used in the preserving of foods. Poisonous substances from decaying food often injure the system and sometimes produce fatal results (see PTOMAINE). Decaying food, of course, should not be eaten, though some people like the flavors that develop in meat that has begun to decay. Game is sometimes left hanging until it has acquired such flavors. It is then said to be "high." The flavors of some sorts of cheese are also developed by the organisms concerned in decay; these are called *putrefactive organisms.* J.F.S.

DECORA'TION DAY, or **MEMO'RIAL DAY,** one day in the spring of each year set apart as a legal holiday in most of the states of the American Union, to do honor to those who fought on either side in the War of Secession. Out of an expression of love and grief by bereaved women of the South—the strewing of wild flowers on the graves of their soldier dead one certain day each year—has grown a nation-wide and beautiful custom. Since 1899 the celebration of the day has been extended

Decoration Day

SUGGESTIVE PROGRAMS

1.

One flag, one land, one heart, one hand,
One nation evermore! *Holmes*

Song, *Battle Hymn of the Republic*
Flag Salute
For Decoration Day.....*Rupert Hughes*
Over Their Graves.....*H. J. Stockard*
Ode for Decoration Day (Extract)...
.....*Peterson*
We'll Honor the Graves..*A. S. Sherwood*
Song, *Columbia the Gem of the Ocean*
May 30, 1893.....*J. K. Bangs*
"A Prophecy," from *Lincoln's Grave*..
.....*Maurice Thompson*
The Soldier's Grave.....*E. P. Nicholson*
The Ship of State.....*Longfellow*
Memorial Day.....*H. H. Jackson*
Song, *America*

2.

No more shall the war cry sever,
Or the winding rivers be red;
They banish our anger forever
When they laurel the graves of our dead!

Song, *The Star-Spangled Banner*
Essay, *The Meaning of the Day*
The Blue and the Gray.....*F. M. Finch*
Conquered at Last.....*M. L. Eve*
Decoration.....*Higginson*
The American Flag.....*Drake*
Song, *Cover Them Over with Beautiful Flowers*
Salute to Our Flag.....*B. E. Burke*
Scatter Your Flowers...*M. N. Robinson*
A Georgia Volunteer...*M. A. Townsend*
Ode for Decoration Day.....*Timrod*
The Palmetto and the Pine.....*French*
Song, *Hail Columbia*

to include the honored dead of the Spanish-American War.

General John A. Logan, commander-in-chief of the Grand Army of the Republic, in 1868 designated the thirtieth day of May as the day on which the graves of dead Union soldiers should be decorated, and this date is now universally observed throughout the Northern states. April 26 is appointed as Memorial Day in Alabama, Florida, Georgia and Mississippi; in North and South Carolina the day set apart is May 10; the second Friday in May is observed in Tennessee; and in Louisiana, Jefferson Davis's birthday, June 3, is also that state's Memorial Day. Decoration Day is now a day of dignified addresses, exercises, parades and military salutes, as well as strewing of flowers and planting of shrubs.

DECOY, *de koi'*. Hunters of wild ducks and geese have a number of methods of inducing their prey to come within gunshot by attracting them to other birds, either captive or artificial, called decoys. Sometimes a ring is fastened around the leg of a captive duck, and a weight is hung from the ring by a few feet of rope. When, with two or three others held in a like manner, the duck is placed in the water, it flutters about within a narrow range and chatters loudly, and passing flocks fly down to see what is the matter. With geese a similar end is gained by placing captives with clipped wings in a large enclosure, around which they can walk but over the walls of which they are unable to fly. Artificial birds may be of wood, shaped and painted, or of air-tight canvas which takes the proper form when inflated.

A LIVING DUCK AND A CANVAS DECOY

In England the name decoy is also given to traps into which wild ducks are lured in search of food. A very natural mistake is often made by some people in calling these contrivances *duck-coys*.

DEDHAM, Mass., a town of Norfolk County, of which it is the county seat, ten miles southwest of Boston. Dedham includes three villages and is a residential suburb of Boston. It is on the Charles River and on the New York, New Haven & Hartford Railroad, and has electric interurban service. The population, which in 1910 was 9,284, was 11,043 in 1915, according to the state census. The area of the town is nine square miles. Dedham has a fine courthouse, public library, Historical Society building, and a jail and house of correction. The chief industrial establishments are manufactories of woolen goods, machinery and pottery. The town, one of the oldest in the state, was settled in 1636 and named Contentment, and was incorporated under its present name the following year. In 1645 the first public school in America supported by a tax of the people was established there.

DEDUCTIVE, *de duk'tiv,* **METHOD,** a method of teaching in which definitions, principles and rules are stated, and then applied to the solution of a problem or in the classification of facts before the pupil. The teacher who requires her pupils to learn the rules in arithmetic and then use these rules in the solution of the problems assigned in their daily lessons is teaching by the deductive method. The teacher who requires her pupils to learn the definitions in geography and then to apply these definitions to the forms of land and water is also using the deductive method.

The deductive method is often called the method of authority, since it requires the pupil to accept the knowledge gained by another. It is also the method of applying knowledge. When the pupil is old enough to reason, and has arrived at that maturity of judgment which will enable him to determine what rules, definitions or principles to apply to the problem in hand, the deductive method has many advantages. It enables the pupil to apply the knowledge he has already acquired and in this way to fix it firmly in mind; it also saves time. The use of the deductive method increases as the pupils advance in the grades, and most of the text-books designed for grammar grades are based upon the deductive plan, especially those in mathematics, geography and history.

The four successive steps necessary to the success of the deductive method follow:

1. A clear understanding of the problem to be solved.
2. Examination of the principles, definitions [illegible] knowledge possessed by the pupil.
3. Application of the related knowledge to the problem.
4. Testing this application to determine whether or not the correct solution has been reached. See Inductive Method.

DEED, in law, a written contract or agreement, and the evidence of its execution. When the term is used without special qualification it means a written contract for conveying real estate—land and buildings—either by sale or gift. Deeds are of two sorts, *quitclaim* and *warranty*. The quitclaim deed conveys to the purchaser the rights held by the party who sells, and no others; in other words, the seller disposes of his rights in the property, but does not guarantee the purchaser against claims of others. Should the seller's title be faulty, the purchaser under a quitclaim deed cannot recover damages from the seller unless he can prove fraud on the part of the latter.

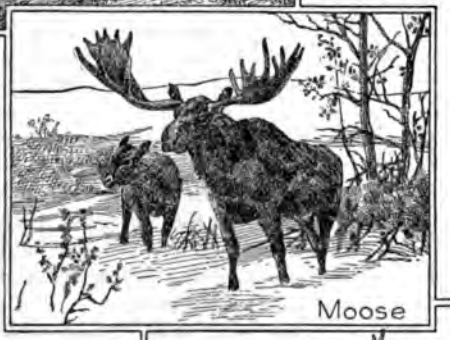
In a warranty deed the party who sells the property agrees to defend the title against all claims that may be brought against it; in other words, the seller guarantees, or warrants, that the property he transfers is handed over with a perfect title. Should the title unexpectedly prove defective, the purchaser may recover the money paid, with interest, provided the one who sold the property has sufficient means to pay the claim; otherwise the purchaser must stand the loss.

A deed must always be in writing, and must be signed by both parties to the contract, and sealed. Two witnesses are usually required, and the deed should be acknowledged before a notary public or some other official authorized to administer oaths. *Acknowledgment* consists in the seller's declaration under oath that it is his own full act.

When the purchaser receives the deed he should have it *recorded* in the proper office; in most instances this is the office of the registrar of deeds for the county in which the property is located. Every deed should be accompanied by an *abstract of title,* which is a record of all transfers of the property from the original owner (the state) to the present purchaser. The validity of the title depends upon the validity of this abstract.

Torrens System. In the Torrens system, described in this work, under that title, the warranty deed is replaced by a simple transfer, which is given to the registrar together with the duplicate certificate of title in order that a new certificate may be issued.

DEEP-SEA FISHERIES. See Fish, subtitle *Deep-Sea Fisheries.*

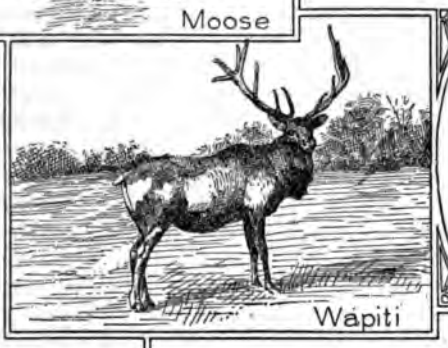


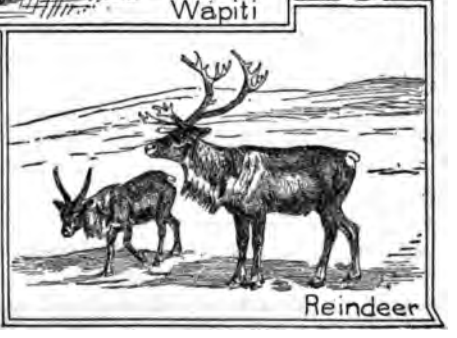
DEER, a family of forest-loving, fleet-footed and antlered (horned) animals, slender of limb and with brown eyes large and questioning. To the deer belong the elk, a noble game animal; the reindeer, puller of Northern sledges; the caribou, the moose and the wapiti, each of which is described in these volumes under its individual title. Deer are widely distributed over the world, though there are none in Australia and few in Africa, the antelope corresponding to the deer in the latter continent.

Distinguishing Characteristics. All male deer, also called *stags, bucks* or *harts,* have solid, branching horns, or antlers, which they shed each year. Excepting reindeer, female deer, known as *hinds* or *does,* do not bear antlers, nor do the young, which are known as *fawns.* Antlers are outgrowths from bone and are at first very sensitive, being covered with flesh and velvety skin. When the antlers are fully developed, the skin dries and is removed by rubbing against trees, leaving bare bones. These are valued by man as trophies of the hunt, for umbrella handles, and sometimes for knife handles. Some antlers spread into broad palms which send out sharp snags around their outer edges. Others divide fantastically into branches, some of which project over the forehead, while others are reared upward. From the number of branches the animal's age can be told.

These gentle animals are cud-chewing creatures; they live on leaves, herbs and lily pads in summer, and on lichens, moss and bark in winter, the stags eating only fungi in breeding time. Most deer feed at night; the elk, however, roams about for its food during the morning and afternoon. Each season deer don a new coat of short, brittle hair, the color of which varies with the colors of nature of that time of year. In most deer the senses of hearing, sight and smell are very keen.

Hinds usually bear one fawn early in the summer, although there are occasionally two or three. The fawns stay with the mother two or three years, after which they wander off to mate, although it is said they are not full grown for fourteen or fifteen years. In the United States and Canada the stately mule deer of Rocky Mountain regions, the Columbia black-tail deer of dense Pacific coast forests and the white tail deer are prominent.





It seems almost unbelievable that any human being could shoot one of these animals, when, a picture of peace and innocence, it stands drinking at some rippling mountain stream at sunset time, or when startled bounds gracefully through the woodlands, a beautiful, frightened thing. Hunting deer has been a favorite sport in America, as in Europe, from frontier times, and it became necessary, eventually, to make laws to prevent the extinction of this species. If such laws were not made and enforced, soon *venison,* the meat of the deer, and leggings and gloves of *buckskin,* made from their hides, would be but things of the past, to be read about only in Indian tales, and in such books as Cooper's *Leatherstocking Tales;* and the beautiful animal itself would peer at us only through the netting of some park fence or perhaps only from the canvas of a Landseer. See GAME, subhead *Game Laws.* M.S.

Consult Roosevelt's *Deer Family; Deer Farming in the United States* (Farmers' Bulletin 330, Department of Agriculture).

DEER MOUSE, a name commonly applied in North America to a small, gnawing animal closely allied to the mice and jerboas of Europe, Asia and Africa. It is usually about four inches long, colored reddish yellow on the back and white underneath. The *jumping mouse,* or deer mouse of Canada, is found in considerable numbers in the districts immediately south of Hudson Bay. It is a strong, active creature, with long hind legs and very short forelegs which it uses as paws, like a squirrel. Its long hind legs and tail give it extraordinary jumping powers, a leap of ten feet being easily accomplished. It has a pouch in each cheek in which it carries grain and seeds, to be stored in underground chambers for winter food. The store of food is never touched until it is impossible to obtain any more above ground.

DEFOE, or **DE FOE,** *de fo',* DANIEL (1660-1731), an author of imperishable fame, beloved by boys and girls because he wrote *Robinson Crusoe.* This was one of the first examples of English prose fiction, and it still ranks among the greatest adventure stories in all literature. Defoe was the son of a butcher and was educated for the ministry, which, however, he abandoned, because it was not to his liking. Going into business, he became a hosier and for a time prospered, but eventually he failed and was declared bankrupt. Friends helped him to make a fresh start, and his second venture proved profitable. He early turned his attention to politics and writing; his first publications were satires that brought him into trouble with the government and eventually led to his imprisonment. He strongly supported William of Orange, and his poem *The True Born Englishman,* defending the king, brought him prompt recognition.

DANIEL DEFOE

In 1719 he published *Robinson Crusoe. The Memoirs of a Cavalier, Captain Singleton, Roxana* and *Journal of the Plague Year* followed, and established his reputation among the greatest writers of his time. Defoe possessed in a remarkable degree the power of presenting fiction as though it were fact. His descriptions of impossible situations are so natural that they appear not only possible but probable. He was a very prolific writer, issuing pamphlets on such varying subjects as religion, politics, commerce, banking and the education of women. His views on these subjects were decidedly modern, and it might be said of him that he was "born before his time." See ROBINSON CRUSOE.

DEGENERATION, *de jen er a'shun,* a word which means *growing worse,* or, to state it scientifically, *falling away from the genus.* Degeneration has special meanings according to the particular science in which it is used.

In Medicine. In medicine degeneration is applied to those changes in tissues and organs which prevent them from performing their functions normally. There are various sorts of degeneration, to each of which physicians have given a Latin name. Degeneration may be caused by old age, by lack of sufficient nourishment, by inactivity, by poisons and by infectious diseases. The liver and kidneys, among the organs, and the mucous membrane, among the tissues, are the most liable to degeneration. Fatty degeneration consists in the accumulation of fat in or around the heart, arteries, liver and other organs. Albuminous degeneration, or cloudy swelling, consists in fine granulation of cells in certain organs, particularly the kidneys and brain.

In Plants and Animals. Degeneration in plants and animals is due to several causes, chief among which are lack of nourishment, unsuitable location and breeding for special purposes.

The first and second causes may be illustrated by plants growing year after year in a poor soil or in an unsuitable climate, or both. The plants will be smaller than those from which the seed was taken. If the seed from these smaller plants is planted season after season an inferior plant, from which no better stock can be obtained, is the final result. This is equally true of animals. The wild horses formerly found in large numbers on the Great Plains in North America and still found in South America are far inferior to the stock from which they sprang.

The second cause is breeding (which see). To illustrate, the development of the double rose was accomplished at the expense of the power of the rose to reproduce itself from its seed. The development of the dairy cow is at the expense of the animal's beef-producing qualities, and the development of the draft horse is at the expense of speed. Degeneration of this sort is not injurious as a whole. The breeder secures the perfection of certain qualities for a given purpose, for which he is willing to sacrifice the other qualities.

Mental and Moral Degeneration. Careful study of crime and delinquency shows beyond question a close relation between physical and intellectual and moral degeneration. By far the larger number of boys and girls brought before juvenile courts are in some respects physically as well as mentally defective. The offspring of defectives are also likely to be defective; hence degeneracy tends to produce degeneracy. There are, of course, exceptions to this rule, since now and then a member of a family in excellent standing is a degenerate. Again, degeneracy may be the result of bad habits which have been followed so long that the victim is unable to regain his former mental and moral state. Alcohol is a potent cause of physical, mental and moral degeneration. See HABIT.

Mental and moral degeneration may apply to a community as well as to an individual. Under slavery entire peoples, as, for example, some of the tribes of Central Africa, have been reduced to a condition little above that of the lower animals. In these cases the degeneration is not entirely confined to the enslaved people; the master is said to be affected as well as the servant. "He who is served is limited in his independence," and no one sustains the relation of master to these almost savage African slaves without themselves being adversely affected.

Living under unhealthful conditions, such as those which the people of the crowded tenement districts in large cities are compelled to endure, is another fruitful source of society degeneration, and certain occupations, especially those connected with the distribution of intoxicating liquors and those which require no intellectual effort, produce a similar effect.

Principles. Certain principles underlie all forms of degeneration. They are:

1. A function or an organ is weakened and finally killed by lack of use. A good illustration is the vermiform appendix in the human body, which is believed once to have been a useful organ, aiding digestion, but which is now not only useless but in some cases dangerous (see VERMIFORM APPENDIX).

2. A persistent course in degeneration in time leads to a state from which it is impossible to return to the former condition. This is equally true of plants and of animals. A draft horse cannot be developed out of a wild pony, neither can a larger variety of corn be produced from the small corn grown in the northernmost part of the corn-growing regions.

3. In man, physical degeneration lies at the foundation of most of his intellectual and moral degeneration. See CRIMINOLOGY. W.F.R.

DEGREE, IN MATHEMATICS. Because the circumference of every circle is 3.14159+ times its diameter, it is necessary in any case to know only one of these dimensions in order to learn the other (see CIRCLE). Therefore to compute the length of an arc of a circle of known diameter, we need only be told how large a part the arc is of the whole circumference. This is one reason why it has been found convenient to say that the circumference of a circle is made up of 360 equal parts called *degrees,* and to subdivide each degree into 60 *minutes* and each minute into 60 *seconds.* There are many other advantages of this division of a circle. Because of it, angles may be measured, thus making possible the science of trigonometry, without which engineers could not survey or mariners steer with accuracy. It also gives a means of describing the exact location of points on the earth's surface. More about the degree will be found in the articles ANGLE; CIRCLE; LATITUDE; LONGITUDE; MERIDIAN.

Measurements in degrees are indicated by symbols, as in 40° 42′ 16″, which means 40 degrees, 42 minutes, 16 seconds.

In Education. One who has completed a course of instruction in an institution of learning is usually granted a title called a degree. In general, these academic degrees indicate how long and what their holders have studied, but the significance of each title varies widely between countries and between schools in the same country. Some degrees, like Doctor of Laws, are often given by universities in honor of success in other lines than learning. The most common degrees will be found listed in the article ABBREVIATIONS, in Volume I.

DE GROOT, *de grote'*, HUGO. See GROTIUS, HUGO.

DE KALB, ILL., a city in De Kalb County, in the north-central part of the state, the seat of the Northern Illinois State Normal and Training School. It is fifty-eight miles west of Chicago and seventy miles east of Clinton, Ia., and is on the Chicago & North Western and the Chicago & Great Western railroads and an electric railway. The city has an area of two square miles. It was settled about 1838 and bore the name of Buena Vista until 1840. In 1861 it was incorporated and in 1877 was granted a city charter. The population, largely American, but containing also Swedish, Lithuanians, Finnish and English, in 1910 was 8,102; in 1916 it was 9,482.

The building of the State Normal School was completed in 1897 at a cost of $245,000. The Training School building, added in 1907-1908, cost $74,000, and the dormitory, built in 1914-1915, cost $114,000. Besides two small parks, the city maintains two public playgrounds. De Kalb is called the *Barb City*, referring to barbed wire, the chief manufactured product. The important industrial plants include wire-drawing and woven-wire mills, agricultural implement works, and manufactories of pianos, shoes, gloves, mittens, nails and creamery-packages. An engagement of the Black Hawk War took place at De Kalb, and after the battle a conference was held there by Lincoln, Jefferson Davis and Zachary Taylor. G.N.B.

DE KALB, JOHANN, Baron (1721-1780), a German-American soldier who won distinction in the Revolutionary War. He was born at Hüttendorf, in Bavaria. His name was simply JOHANN KALB, the "Baron" being self-styled. In 1743 he entered the French army and was promoted rapidly, becoming brigadier-general in 1761. In 1777 De Kalb came to America with Lafayette and during the same year was made a major-general by Congress. He took high rank in the armies of Washington in Pennsylvania and New Jersey, was second in command under General Gates in the Carolinas and led the American forces at Camden. In the latter engagement he was wounded eleven times, which resulted in his death a few days later. In 1825 Lafayette laid the corner-stone of a monument to De Kalb at Camden, and in Annapolis, in 1887, a statue of him was dedicated.

BARON DE KALB

DE KO'VEN, REGINALD (1861-), a leading American composer, whose melodious and picturesque opera, *Robin Hood*, produced in 1890, was the first work by an American composer to take rank among standard light operas. He has also composed numerous attractive songs, his *O Promise Me* being a universal favorite. De Koven was born in Middletown, Conn., and was graduated at Saint John's College, Oxford University, England. He studied music in Stuttgart, Florence, Paris and Vienna. His successful opera, *The Begum*, produced in 1887, was the first of a notable list that includes, besides *Robin Hood, The Algerian, Rob Roy, The Mandarin, Red Feather* and many others, all of which are characterized by refinement of melody, richness of harmony and skill in construction. *Margery Daw, A Winter Lullaby, Indian Love Song* and *Ask What Thou Wilt* are among his best songs. De Koven has acted as music critic for several New York publications, and was the founder of the Washington Symphony Orchestra. His wife, Anna Farwell De Koven, is the author of an excellent biography of John Paul Jones.

DELAGO'A BAY, an inlet of the Indian Ocean indenting the coast of Portuguese East Africa. The southern portion of the bay is protected from the rolling waters of the ocean by the Inyack peninsula and island. At the head of the bay stands Lourenço Marques, an important port with excellent harborage. The bay has been well dredged and vessels of the largest size can lie alongside the docks. Since the opening of a railway in 1895 from Lourenço Marques to Pretoria, capital of the Transvaal, the commercial importance of Delagoa

Bay has greatly increased. The gold and other products now find a ready outlet to the sea, and the longer freightage to Durban or Cape Town is avoided.

Since the South African War the progress of British South Africa generally has been so rapid that the Portuguese authorities, who control the shipping to and from Delagoa Bay, have been compelled to take steps to meet the demands of traffic. The result has been beneficial to the Transvaal, and especially so to Lourenço Marques, or Delagoa Bay; the latter term is now commonly applied to both port and bay.

DELAWARE, THE BLUE HEN STATE, one of the Middle Atlantic states, formerly known far and wide for its production of peaches, which suggested the peach blossom as the state flower. It is one of the original thirteen states of the American Union. Although almost twice as large as Rhode Island, it is the second smallest state in the Union. Texas would make 112 states the size of Delaware. Within its area of 2,370 square miles live 209,800 people, according to the census of 1910, an average of 103 to the square mile. This is one-thirteenth the population of Texas. An estimate by the Census Bureau January 1, 1917, placed the population at 213,380. The state was named after Lord de la Warr, who entered the bay east of the state in 1611.

It is said that the nickname, *Blue Hen State*, was given to Delaware during the Revolutionary War. A Delaware officer was heard to say that no cock was game unless it came from a blue hen, and thereafter Delaware soldiers were called *The Blue Hen's Chickens*.

Position and Physical Features. Its northern semi-circular boundary divides Delaware from Pennsylvania. This strange boundary was drawn on a twelve-mile radius from the courthouse of the city of New Castle. On the east are the Delaware River, Delaware Bay and the Atlantic Ocean. The straight southern boundary of thirty-six miles, and the ninety-mile straight western boundary, meeting the southern at right angles, separate Delaware from Maryland. From the south, the state tapers gradually to its narrowest region near the north, where it is only nine miles across.

The northern portion of Delaware is a beautiful, fertile region of hills and dales. The highest elevation of the state is 327 feet, at Southwood, near the northern border. Continuing southward, the land surface is uniformly low, level and generally sandy. In the extreme south is an area of swamp land, twelve miles long and six miles wide. That region is covered with cypress and evergreen forests and is known as Cypress Swamp.

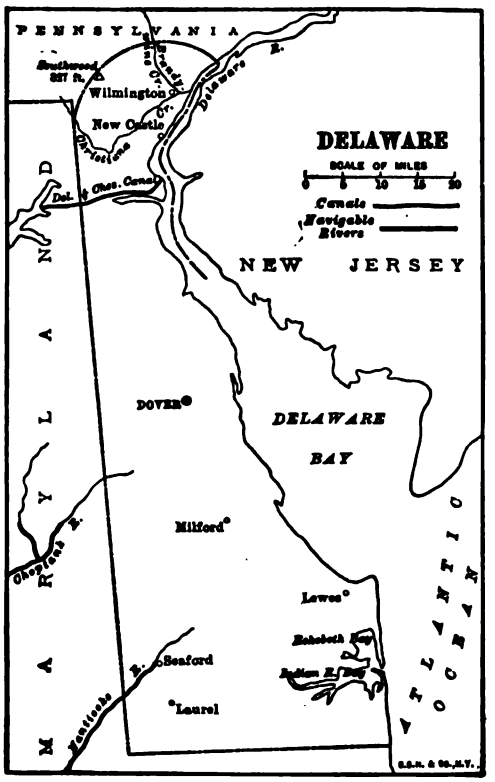
Through the state from north to south runs a long, low divide separating the numerous small streams, which flow east to Delaware Bay and west to Chesapeake Bay. Most of Delaware's streams are not navigable. Vessels go as far as Wilmington up the mouth of Christiana Creek, and as highways to the interior for smaller craft the streams Brandywine, Christiania, Duck, Murderkill, Jones, Mispillion, Indian and Nanticoke are most notable.

The marshy shores along Delaware Bay offer few good harbors, the best ones being at Lewes, near the south, and at New Castle and Wilmington at the north. The construction of the Delaware Breakwater, a remarkable feat of engineering which cost over $2,000,000 and forty years of work, has insured an especially safe harbor at Lewes. Many sand beaches enclose shallow lagoons on the Atlantic coast; none of those waters is useful, however, excepting Rehoboth and Indian River bays, whose common outlet, the Indian River Inlet, permits navigation by small vessels. The Delaware and Chesapeake Canal, thirteen and one-half miles long, from Delaware City to Chesapeake City, Md., affords passage for barges and small steamers.

Climate. Excepting in the southern part of the state, where the swamps breed fever, the climate of Delaware is mild and healthful.

Autumn is particularly pleasant, and frosts seldom occur until about the middle of October, but they may occur in spring as late as the end of April. The average yearly temperature is 55°.

There is ample rainfall to insure good crops, and although occasional droughts cause dam-



OUTLINE MAP OF DELAWARE

Showing boundaries, principal streams and canal, chief cities and location of the greatest elevation in the state.

age, rainfall is usually quite evenly distributed throughout the year. The average rainfall is from forty to forty-five inches.

Agriculture. The soils of Delaware are well adapted to agriculture, and eighty-five per cent of the land is under cultivation. The value of Delaware crops each year is about $10,000,000. The state is well known as a market garden and orchard, especially for the cities of New York, Philadelphia and Baltimore. The leading crops are corn, wheat, hay and forage, which are produced in the rolling country at the north. Apples, potatoes, sweet potatoes and yams also produce a considerable yield. [redacted]ne-half the total value of crops of the contributed by cereals, one-fifth by potatoes and other vegetables, and about one-eighth by hay and forage.

Although when the state of Delaware is mentioned the peach crop is first in mind, apples are now the most important orchard fruit, and pears sometimes rank next in value. After peaches, fruits of less importance are grapes, cherries and quinces. Every year large quantities of cantaloupes, over 350 carloads of watermelons, about 15,000,000 quarts of strawberries and smaller quantities of other berries reach the great markets from Central and Southern Delaware. In market gardening, the tomato is the principal crop, thousands of acres being devoted to that vegetable alone.

Domestic animals, poultry and bees kept on Delaware farms are worth about $7,000,000. Dairying interests are increasing, and the milk, cream, butter and cheese sold or made each year are valued at over $1,000,000.

Most of the natural woods of the state have been cut away, excepting the cypresses and evergreens of the southern swamps, yet the forest products on farms alone average nearly $350,000 yearly.

Minerals. The mineral resources of Delaware are not extensive, yielding usually less than $500,000 a year. This amount is represented by the output of its stone quarries, and by its clay, sand, gravel and mineral waters.

Manufactures and Industries. Manufacturing is the chief industry of the state, the yearly output of manufactured goods being valued at about $55,000,000, an average of over $180,000 worth each working day. The most important industries are those relating to leather, foundry and machine-shop products, paper and wood pulp, canning and preserving, building of cars for steam railroads, shipbuilding, iron and steel, flour and grist and lumber and timber products. Most of these industries are confined to the city of Wilmington, over forty-five per cent of the population of the state being centered in that section. The canning and preserving industries, however, are conducted outside of Wilmington.

It is interesting to note that the first iron sailing vessel of America was built at Wilmington in 1854; that in Wilmington are located some of the largest "morocco" leather plants in the world; that near Wilmington are located the great Du Pont powder works, the oldest and largest of their kind in the United States.

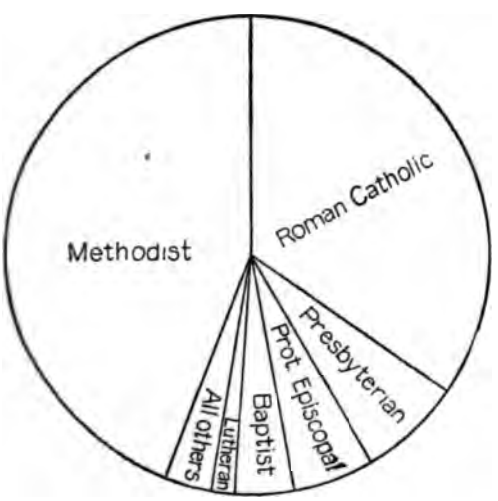
The fisheries of Delaware are growing, although they have not as yet reached especial

importance. Their products are valued at about $545,000 a year, the most important fish taken being menhaden, oysters and shad.

Transportation and Commerce. No part of Delaware is far from navigable water or from railways which afford connection with the largest railways of the East. The total railway mileage is about 400, the two most important railroads being 275 miles of the Pennsylvania system, and the Baltimore & Ohio. There are only about 125 miles of electric railway, although extensions are being made at a comparatively-rapid rate.

An active coastwise trade exists between Wilmington and New York, those cities being connected by a line of steamers. There is also some foreign commerce through Wilmington. Chesapeake and Delaware bays are connected by a canal. The harbors at New Castle and Lewes encourage coastwise and internal trade. Recent government appropriations provide for improving the harbor at Wilmington and for dredging channels in several of the larger streams in the state.

The People and Principal Cities. Fifteen per cent of the population of Delaware are colored. Of the white population about eight per cent are foreign-born, chiefly of Irish, German, English and Italian parentage.



RELIGIONS IN DELAWARE

The city of Wilmington, in the extreme north of Delaware, is the largest city. Dover, in about the center of the state, is the capital, and other cities of importance, besides the harbor towns of New Castle and Lewes, are Milford, Middletown, Smyrna, Georgetown, Seaford and Laurel. The most important of these are described in these volumes.

Education. Although education in Delaware has long been the subject of thoughtful care and constant improvement, yet more efficient instruction of the young is promised. Coöperating with the United States Bureau of Education, the Delaware state school system is being built up as a model educational unit, and it is probably destined to serve as a guide to other commonwealths which may desire a more thorough and united educational system than they now possess. All schools, from little district schools to the State College for Colored Students at Dover, and the Delaware College for men at Newark, will be included in the new plans.

A law passed by the legislature in 1907 makes school attendance compulsory for children between the ages of seven and fourteen. School sessions in rural communities vary from seven to ten months a year, and children living over two miles from a school are excused. Separate schools are provided for white and colored children. Over 22,500 children attend the public elementary schools, and about 1,800 pupils are taught in the high schools. The state has no normal schools, but has a normal department in the Women's College at Newark. Under the new educational system proposed this plan will doubtless be altered.

The state supports a hospital for the insane and an industrial school for boys and one for girls. It contributes to institutions outside of the state for the support and training of its deaf, dumb and blind.

Government. After being governed under three constitutions, adopted in 1776, 1792 and 1831, Delaware adopted a fourth in 1897, and this, with a few minor amendments, constitutes the basic law of the state to-day. Delaware is divided into three counties, and each of those into hundreds, or districts, for local government. Wilmington has a specially modified government of its own.

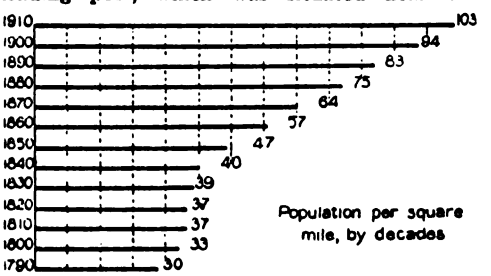
Executive power is vested in a governor, lieutenant-governor, attorney-general and insurance commissioner, each elected for four years, and in a state treasurer and an auditor of accounts, who serve two years.

The legislative power is vested in the general assembly. It consists of a senate of seventeen members, elected for four years, and a house of representatives of thirty-five members, elected for two years. Senators must be twenty-seven years old and representatives

twenty-four. A voter must be twenty-one years of age and able to read English and to write his name. Every male citizen with those qualifications is entitled to vote in the election district in which he registers, if he has been a resident of the state one year, of the county, three months, and of the district, or hundred, thirty days, next preceding the election.

Judicial powers are vested in six judges, one of whom is chancellor, one chief justice, and the other four associate justices. All are appointed by the governor and confirmed by the senate.

History. Although the Englishman, Lord de la Warr, sailed into Delaware Bay in 1611, the first settlement in the colony was made by the Dutch, just twenty years later. That trading post, which was situated near the



SHOWING INCREASE IN POPULATION

present site of Lewes, was destroyed by Indians in 1633. In 1638 the Swedes made an attempt to secure a shore line in America by founding the colony of New Sweden, near the present site of Wilmington and extending as far as Philadelphia. The Dutch resented this invasion of what they considered their property, and within four years open conflict ensued. By 1655 the Swedes were driven out, and the Dutch took possession of all that section. When New Amsterdam, the present New York City, passed into English hands in 1664, Delaware also came under English control, and contention arose between the Duke of York and Lord Baltimore. In 1683, however, William Penn secured the territory, and for twenty years it was governed as part of Pennsylvania. In 1703 it was granted a separate assembly, but the authority of Pennsylvania's governor was acknowledged until the Revolutionary War. Throughout that war Delaware soldiers rendered noteworthy service. In 1776 an independent state government was formed, and Delaware was the first state to ratify the Federal Constitution in 1787.

As a slave-holding state, Delaware furnished

Research Questions on Delaware

(An outline suitable for Delaware will be found with the article "State.")

Why has Delaware fewer navigable streams than it had two centuries ago?

Do the farmers of the state have to provide for irrigation?

How many miles of railroad are there to one hundred square miles of area? How does the state compare in this regard with the state which most closely resembles it in size? With California?

Who was the real discoverer of Delaware Bay? Why did he not explore it?

What qualifications must a man have to enable him to vote in Delaware?

Where is the great breakwater? How much did it cost, and how long was it in building?

Who are the "white Indians," and what has tradition to say concerning them?

What industrial plant in this state outranks in age and size all others of its kind in the country?

What is meant by "hundreds"?

Has the state many navigable waterways?

What incident in the history of the American flag is marked by a monument in this state?

How many dollars' worth of manufactured goods is produced in Delaware for each working day in the year?

How does the state care for its blind and its deaf and dumb?

How many times as valuable as its yearly mineral output is its agricultural production? The output of its factories?

To what children within the state does the compulsory education law not apply?

Give two popular names applied to this state, and explain both.

In what unusual way was the northern boundary of the state established?

What do the farms produce that is not counted as agricultural products?

How many states have a greater proportion of their land under cultivation than has Delaware?

What fruit is most closely associated in the popular mind with this state? Is it the most important now?

How many cities in this state have a population greater than 10,000?

How many cities the size of the capital of Delaware would the capital of New York make?

At what stage has the state arrived on the liquor regulation question?

How many states have a population smaller than that of Delaware? How many have fewer people to the square mile?

What proportion of the total agricultural output is made up of cereals?

What engineering project besides the breakwater at Lewes has been of great aid to transportation?

Who made the first settlement on Delaware territory? When? How did the land come into the possession of England?

many recruits to the Confederate army during the War of Secession, but as a government it remained faithful to the Union and was quick in its response to the call for troops. In recent years political factions of the Republican party have fought for control of the state, and as a result Delaware was without representation in the United States Senate from 1901 to 1903. A troublesome question is liquor regulation, and as a result of the elections of 1910 licenses are required for the sale of liquor in New Castle County, including Wilmington, while Kent and Sussex counties continue to be anti-saloon territory. E.D.F.

Other Items of Interest. Hudson discovered Delaware Bay and explored its mouth six days before he entered the Hudson River, but he did not proceed far inland because the bay was too shallow.

The Indians who lived in this region at the coming of the white man were the Lenni Lenape, or "real men."

In Sussex County and the surrounding region there is a colony of so-called "white Indians" or "Moors." Tradition declares that these are the descendants of Moors from Spain, but their exact origin is unknown.

It was during a battle on Delaware soil that the new American flag was first unfurled on land, September 3, 1777. The spot where this occurred is indicated by a monument.

Only one city in the state—Wilmington—has more than 5,000 inhabitants.

When the white men first entered this territory it was far better watered than at present. Forests have been cut and swamps have been drained, and in the process many streams have disappeared, while others, once navigable for large vessels, are now of use only for the smallest craft.

No other state has so large a proportion of its land under cultivation.

Because of its diminutive size, Delaware is frequently known as "The Diamond State."

More than one-sixth of Delaware's area, or 405 square miles, is water surface.

Consult Pyle's *Once Upon a Time in Delaware;* Conrad's *History of the State of Delaware.*

Related Subjects. The following articles in these volumes, even when they do not make specific mention of Delaware, contain information which will help to make clearer the life and activities of that state.

Apple	Leather
Delaware, Thomas West	Peach
Delaware Bay	Powder
Dover	Wilmington

DELAWARE, a tribe of American Indians belonging to the Algonquian family, living, when first known, on the Delaware River. They called themselves *Lenni Lenape,* which meant *real men.* They occupied Eastern Pennsylvania and most of New Jersey. It was with these Indians that William Penn made his celebrated treaty, and from their great chief Tamanend the Tammany Society (which see) of New York takes its name. Because they occupied the central home of the Algonquians they were given the title of *grandfather* by all the tribes of that great family. Driven from their original home by the progress of the whites, they removed westward. Fewer than 2,000 now remain, and they are scattered among other tribes. For habits and customs, see INDIANS, AMERICAN. See, also, PENN, WILLIAM.

DELAWARE, a river of the Eastern United States, formed by the junction of two small streams in the Catskill Mountains, New York. This river is the greatest shipbuilding center, after the Clyde, in the world. It forms the northeastern boundary between New York and Pennsylvania and the entire boundary line between Pennsylvania and New Jersey. Its general course is southward, passing through the Kittatinny Mountains near Stroudsburg, Pa., and flowing through the gorge known as the Delaware Water Gap (which see). Its length is about 350 miles from its source to Delaware Bay, into which it flows about five miles below New Castle. The Schuylkill and Lehigh rivers are its most important tributaries. Tidewater is met at Trenton, after which it becomes an inlet of the sea; Philadelphia, fifty-five miles above the head of the bay, is at the head of navigation for ocean steamers. The river is an important means of commercial transportation for the busy cities of Trenton, Easton and Camden. The Morris & Essex Canal from Trenton to New Brunswick also facilitates commerce, and the Delaware & Chesapeake Canal connects Delaware River with Chesapeake Bay. The state of Pennsylvania made a large appropriation for river and harbor improvements south of Philadelphia in 1905.

DELAWARE, OHIO, the county seat of Delaware County, twenty-four miles north of Columbus, the state capital, 116 miles southwest of Cleveland and 100 miles south and east of Toledo. It is on the Whetstone (Olentangy) River, and on the Cleveland, Cincinnati, Chicago & Saint Louis, the Pennsylvania and the

Hocking Valley railroads, and on two interurban lines. Delaware was named for the tribe of Indians of that name. It was laid out in 1808, incorporated as a town in 1815 and as a city in 1827. The area is four square miles. The population, practically all American, was 9,076 in 1910 and 9,790 in 1916.

Delaware is the seat of the Ohio Wesleyan University (Methodist Episcopal), opened in 1844. Gray Chapel, the main building, was erected in 1892 at a cost of $350,000. The city has a Federal building, erected in 1910 at a cost of $75,000, a Carnegie Library and two attractive parks.

The industrial enterprises include manufactures of clay products, gas engines, shoes, cigars and garments; the city also has railroad shops, foundries and limestone quarries. There is a lively trade in the agricultural and stock-raising products of the surrounding country. In the city are sulphur and other mineral springs, whose waters are utilized for medicinal purposes. One of the finest sanitariums in the state is located here.

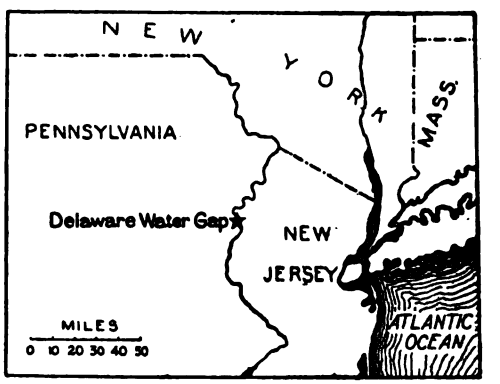
Delaware was the birthplace of Rutherford B. Hayes, President of the United States from 1877 to 1881. The house in which he was born stands opposite the city hall (see HAYES, RUTHERFORD B., for illustration). W.D.T.

DELAWARE, or **DE LA WARR,** THOMAS WEST, Lord (1577-1618), an English nobleman of colonial fame, the first governor of Virginia colony, in whose honor the state of Delaware and Delaware River and Bay were named. At the age of twenty-five he succeeded to his father's estate and title and became a member of Queen Elizabeth's Privy Council. Having become interested in the plans for the colonization of the new lands in America, he was chosen a member of the Council of Virginia in 1609, and on June 10, 1610, arrived at Jamestown as the first governor of the Virginia colonists. He first persuaded the discouraged settlers to give up the idea of returning to England, and then set himself to the task of bringing order and prosperity to the weak settlement. In this he succeeded admirably, though he was much given to pomp and display.

After founding a settlement on the site of the modern Hampton, and building forts Henry and Charles, Lord Delaware started for the West Indies in 1611 to restore his failing health, but was driven by a storm into the river which now bears his name. He then returned to London, where he published his *Relation of the Condition of Affairs in Virginia.* In 1618, while on a second voyage to America, he died.

DELAWARE BAY, a large bay or arm of the Atlantic Ocean, lying between the states of Delaware and New Jersey. It is about forty miles long and thirty-five miles at its greatest width, and has a channel depth of thirty to sixty feet through its entire length. The bay is of great commercial importance, as it enables ocean-going vessels to reach Philadelphia, which lies on the Delaware River a few miles above the point of its entrance into the bay. Philadelphia contends with New Orleans for the rank of second seaport in the country, New York holding first place. At the entrance of the bay, near Cape Henlopen, the Federal government has built a large breakwater to provide shelter for vessels, at a cost of $3,000,000. Lighthouses have also been erected to warn ships of shoal water.

DELAWARE WATER GAP, a narrow gorge about three miles long, in the Kittatinny Mountains, sixty-five miles west of New York, close to the boundary between New Jersey and Pennsylvania, but in the latter state. This



LOCATION MAP

gorge, or canyon, was worn through the solid rock of the Appalachian range many ages ago by the Delaware River when it was slowly forcing its way to the sea. The rocky walls on either side are very steep and high, rising almost perpendicularly 1,400 feet above the water. The scenery is very beautiful, and the surroundings are restful, two facts which combine to make Delaware Water Gap one of the most popular resorts in America.

DELCASSÉ, *del ka sa',* THÉOPHILE (1852-), a French statesman who was instrumental in developing a friendly understanding or "entente" among France, Russia and England, which cemented their interests when the

War of the Nations began in 1914. In 1894 he was appointed Minister of Colonies and in 1898 received the portfolio of Minister of Foreign Affairs. He arranged the alliance with Russia, conducted delicate negotiations with England concerning African affairs and acted as mediator between Spain and the United States. By seeking European alliances he roused the suspicions of Germany and his resignation was called for. He was soon reinstated, and in 1911 became Minister of Marine, in this position effecting great improvements in the French navy. In 1912 he again became Minister of Foreign Affairs, but during the next year was appointed ambassador to Russia.

In 1914 Delcassé returned to France, and was for a few months Minister of Foreign Affairs and then Minister of War. On the outbreak of the War of the Nations he again assumed charge of the foreign office, where he remained until October 13, 1915. He then resigned, ostensibly because of ill health; it is generally understood, however, that his resignation, like the withdrawal of Sir Edward Carson from the British Cabinet, was a protest against the hesitating policy which had allowed the conquest of Serbia by the Austro-German and Bulgarian armies.

DEL'EGATE, a person appointed by another or by a group, to act as his or its representative. The word is derived from the Latin *delegatus,* the past participle of the verb which means *to send,* or *appoint.* In the United States Congress the term is applied to a person elected to represent a territory, as distinguished from a state, in the House of Representatives. Each territory is entitled to send one delegate, who serves two years, receives a yearly salary of $7,500, is allowed to speak and offer motions only on affairs concerning his territory, but may be appointed to certain committees. No delegate, however, may vote on any question. In Congress at the present time there are delegates only from Alaska and Hawaii. The Philippine Islands and Porto Rico send "resident commissioners to Congress." These men, though popularly called delegates, do not possess the rights of the territorial delegates, but are merely entitled to the privileges of the floor.

DELFT, or **DELF,** a picturesque town in the Netherlands, near Rotterdam, founded in the eleventh century. It is intersected by numerous tree-bordered canals crossed by sixty-nine bridges. Among its buildings of historic interest are the Prinsen-hof (meaning *court of a prince*), now a fine museum, where William I of Orange was assassinated in 1584; the town hall; the old Reformed church; and the new church containing the family vault of the House of Nassau, the tomb of William I, the remains of Hugo Grotius, a Dutch statesman, and the burial vaults of the present royal house. The town was at one time famous for the manufacture of a beautiful pottery, the appearance of which, in about 1600, marked an epoch in the art of ceramics. This earthenware in its highly developed form successfully imitated Chinese blue and white porcelain. The industry, which suffered a severe decline in the latter part of the eighteenth century, has been revived, its product receiving the name of "New Delft."

DELHI, *del'e,* capital of the Indian province of the same name, since 1911 the seat of government of British India. It is situated on the west bank of the River Jumna, about midway between Calcutta, on the east, and Karachi, on the west coast. The city was founded by Shah Jehan, builder of the beautiful Taj Mahal (which see) at Agra and of the imperial palace at Delhi, the latter a reminder of the days when the city was the splendid capital of the great Mogul empire, with a population of 2,000,000 (see MOGUL). This palace has given place to British barracks, and few evidences of its former glory are visible. Here, in the audience chamber, once stood the famous Mogul throne, surmounted by a fully-spread peacock's tail made of precious stones and valued at $30,000,000. Near the finest street in Delhi, called the Chandni Chauk, stands the Great Mosque, a beautiful building with three pure-white marble domes. This is also a monument to the pride of Shah Jehan, who on his coronation treated the populace of Delhi to a pageant that cost him more than $6,000,000.

In 1911 the city witnessed another pageant, known as the Delhi Durbar, when King George V and Queen Mary of England were entertained with great splendor (see DURBAR). For political reasons at that time it was thought wise to remove the capital from Calcutta to Delhi, and this was done in the following year. Modern Delhi is far from being the glorious city of old. It is, however, in a fairly flourishing condition. The palaces of the nobles and princes have in many parts given place to the dwellings of European business men. Although the city is still famous for its jewelry and gold and silver work, Western

manufactures have become more important. Modern flour mills look down on the sumptuous dwellings of caste-encircled natives who regard commerce as degrading. Sugar and cotton mills, with up-to-date machinery, provide employment for many thousands of low-caste inhabitants. The trade in grain and other agricultural products is extensive.

Educational facilities have been greatly increased during recent years, and Delhi, by being created the capital of the vast Indian Empire, has developed a civic pride which bids fair soon to place the city far ahead of all Indian rivals. It is more cosmopolitan than most of the Indian cities; racial and religious prejudices, though they exist, are not as apparent to the observer as elsewhere. The political unrest that was formerly characteristic of the city is gradually giving way to a desire for educational and commercial progress. Population in 1911, 232,837.

DELI'LAH, in Scripture, the treacherous mistress of Samson, the man of marvelous strength. Desiring to know wherein the strength of Samson lay, the lords of the Philistines bribed Delilah to discover the secret. Loving and trusting her, Samson told Delilah that his strength came from his long, thick hair; so while he was sleeping Delilah cut off his locks, and he fell into the hands of his enemies. Under the title SAMSON in these volumes is told the story of his revenge for this outrage.

The name Delilah means *drooping,* or *languishing, one.* Delilah is a leading character in Saint-Saëns's opera, *Samson and Delilah.*

DELIRIUM TREMENS, *delir'ium tre'menz,* or **SHAKING DELIRIUM,** is an affection of the nerves and brain, caused by long-continued and excessive drinking of alcoholic liquors. The sufferer has fits of trembling, and his mind becomes so disordered that it is filled with all manner of fantastic imaginings. Frequently he thinks he sees snakes, rats, bats and other loathsome animals, and as a result he suffers greatly from lack of sleep. Unless the progress of the hallucinations is arrested the victim eventually dies in agony of mind and from physical exhaustion. Strychnine, chloral, bromides and other powerful drugs are usually administered to the patient, but the treatment should always be directed by a physician. Baths and douches are sometimes found to be of benefit. It is estimated that about seventeen per cent of those attacked by delirium tremens die from its effects. W.A.E.

DE'LOS, the smallest and the central island of the Cyclades group, in the Aegean Sea, belonging to Greece. It was held in great veneration by the ancient Greeks as a sacred island, the birthplace of the god Apollo. Tradition says it was originally a floating island but was anchored in its present position by Neptune, called Poseidon by the Greeks, to afford a refuge for Leto, mother of Apollo and Artemis. In 477 B.C. the Greek cities formed a league known as the Confederacy of Delos, for protection against the Persians. The common treasury was kept in the temple of Apollo on the island of Delos, which became the political and educational center of all the Grecian states. The power of the league was later transferred to Athens, leading to the foundation of the Athenian Empire.

DELPHI, *del'fy,* an ancient town in Phocis, Greece, called Pytho in the stories of Homer. It was celebrated for its oracle of Apollo (see ORACLES), through which it became the religious center of Greece and the common altar of the Greek race. Delphi lay on the southern slope of Mount Parnassus, in a region of wild and picturesque beauty. From a deep crevice in the rocks issued overpowering vapors, assumed to be the divine breath of Apollo, and over this spot a temple was erected in honor of the god. The priestess, known as the Pythia, who received the messages of the Revealer, sat upon a tripod over the crevice, and as she came under the influence of the stupefying vapors gave utterance to his words. Her mutterings were recorded by priests, who interpreted them in verse.

Though the answers were sometimes in the form of sensible advice, prophecies regarding the outcome of future events were often intentionally obscure or capable of being taken in different ways. Croesus, asking if he should make war on Cyrus, was told that if he did so he would bring ruin to a great empire; in the struggle that he at once brought about it was his own empire that was destroyed. Not only did the Greeks freely consult the oracle, but in times of peril and anxiety the Romans and the monarchs of Asia made their way to Delphi.

DELSARTE, *del sahrt',* **SYSTEM,** a system of relaxing physical exercises, including training in poise and breath control, devised by François A. Delsarte (see below). He taught that every expression of the face, every gesture and every pose of the body was the outward expression of some inner emotion, and that every gesture, every pose and every expression

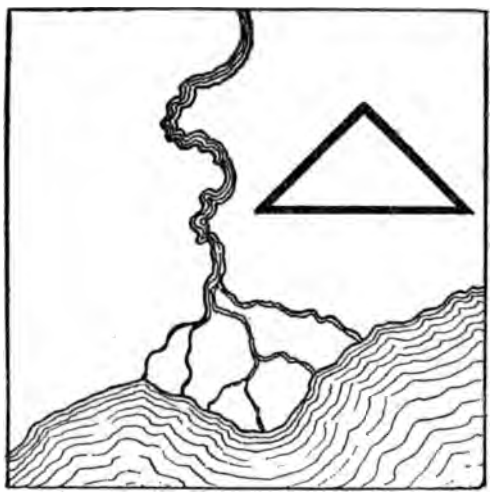
of the features had a characteristic effect on the emotions and on character. He was therefore a teacher of emotional expression.

His first step was to subject the joints and muscles of the body to a relaxing process, to secure perfect freedom of movement and to make the human organism pliable and responsive. His exercises are simple, and include special movements for the fingers, hand, head, trunk, foot, leg, lower jaw, eyelids, etc. The Delsartian movements develop grace and freedom of gesture, but they are not a system of gymnastics, nor are they adequate for the complete training of the physical organism.

François Alexandre Delsarte (1811-1871) was born at Solesmes, France. During a boyhood which was full of poverty and suffering, he developed a remarkable talent for music. Through the influence of a well-known musician, who discovered him writing down in the sand the music that was being played in the garden of the Tuileries, he was admitted to the Conservatory of Paris at the age of fourteen. Five years later he became a singer in light opera, but in 1834 was forced to leave the stage because of the failure of his voice. Thereafter he devoted himself to perfecting his system of expression, which he never put into writing, but which has been handed down by his followers. Among his pupils were the famous French actress Rachel, and the great pulpit orator, Père Hyacinthe. Delsarte was the composer of a number of songs and vocal exercises, and a mass which he wrote was performed in churches.

DELTA, a triangular-shaped tract of land at the mouth of a river, so called from its resemblance to the fourth letter of the Greek alphabet (Δ), corresponding to the English *D*. The name was first applied to the silt or sand deposits built up into a fan-shaped plain at the mouth of the Nile. Since that time the same name has been given to alluvial deposits frequently found at the mouths of large streams flowing into lakes or gulfs, where the effects of tides and currents are comparatively slight. The main stream usually divides into two or more branches, each of which may be divided again and again. The size of the delta bears a close relation to the strength of the current in the body of water, as a swiftly-flowing current carries off the shore line deposits, forming sand bars or coast islands, while slow or sluggish currents build deltas of considerable size.

The delta of the Mississippi has an area of about 12,500 square miles, many thousands of acres being productive land, and it is advancing into the Gulf of Mexico at the rate of one mile in sixteen years. The Nile delta, which has an area of 10,000 square miles, is very fertile. Other noted deltas include those of the Hoang-ho, Ganges and Po. As large



A CHARACTERISTIC DELTA
The upper figure represents the Greek *delta*.

rivers often change their channels near their mouths, delta lands are unsafe for dwelling places because of the danger of floods, but owing to their high fertility they can be used for agricultural purposes if of sufficient elevation to be drained. See RIVER; EROSION; also illustration of the delta of the Mississippi River, in article bearing that title.

DELUGE, *del'uje,* from Latin words meaning *to wash away,* is the name given to the great Flood described in the Old Testament. According to the Bible narrative, thousands of years before Christ the waters covered "all the high hills that were under the whole heaven" and destroyed all living things except those that had been permitted to seek refuge in the Ark built by Noah.

The familiar story, told in chapters VI, VII and VIII of *Genesis,* is one of the most vivid and fascinating of all Bible tales. According to the account, the Deluge was sent to punish the wickedness of men, among whom only Noah and his family were deemed worthy of being saved. With them in the Ark were one male and one female of each living species. For forty days and nights the flood rose, "the fountains of the great deep were broken up, and the windows of heaven were opened."

After 150 days the waters began to subside,

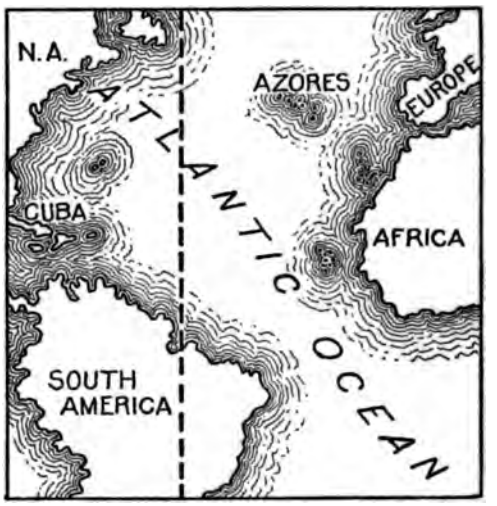
and in the seventh month the Ark rested on Mount Ararat. "Noah's dove," sent forth to test whether the earth were once more fit for habitation, returned after the first trial to find shelter and food in the Ark; the second time it came back bearing an olive leaf; the third time it did not return—a sign that the land was dry and beginning to yield as of old. Then, after having been a year and ten days in the Ark, Noah and his family again set foot upon the new earth, offered thanksgiving to God, and received the promise expressed in the rainbow, that "the water shall no more become a flood to destroy all flesh."

The literal interpretation of the Biblical statement that the Flood covered the entire earth has been modified to harmonize with modern geological discoveries concerning the age of rock strata. Bible commentators now generally agree that either the narrative in *Genesis* described a flood of only local extent, or that the phrase "all the earth" was only relative, since only a small portion of the earth's surface was then known and inhabited.

Nearly every nation has in its folklore a flood tradition similar in many respects to that of the Hebrews. The Greeks had the story of Deucalion's flood, told by the poet Ovid and familiar to students of Greek mythology. Babylon, India, China, Persia, Syria, Polynesia, and even ancient Mexico, Peru and Cuba had their deluge legends. The Babylonian story exerted a strong influence on the Hebrew tradition, and because of its earlier dating it is thought by many to have been the model for the Bible narrative. The clay tablets on which the Babylonian, or Chaldean, account is engraved are known as the Deluge Tablets. Fragments have been unearthed and deciphered at various times, the first translation having been published in 1872 by George Smith, a famous English scholar in Assyriology, and others more recently, in 1910 and 1913.

Celebrated paintings of the Flood are those of Poussin, in Paris, and of Raphael, in the Vatican at Rome. L.M.B.

DEMARCATION, *de mar ka'shun,* LINE OF, the historical name of the boundary line established by Pope Alexander VI to settle the conflicting claims of Spain and Portugal to lands in the New World. By a Papal bull issued in May, 1493, he assigned to Spain all the lands its navigators had discovered, or might discover, west of a line running from north to south 100 leagues west of the Azores and Cape Verde Islands, provided such lands had not previously been in actual possession of any Christian prince or king; Portugal was to possess all the land discovered under the same conditions east of that line. After this concession Spain's possessions were known as the West Indies and those of Portugal as the East Indies. This arrangement proved unsatisfactory to Portugal, and the two countries in 1494 sent commissioners to Tordesillas, a Spanish city, and they succeeded in establishing the line 370 leagues west of the Cape Verde Islands.



LINE OF DEMARCATION
The Pope's division of the Western world, as decided in 1494.

Portugal, on the strength of the extension of this line, eventually claimed and secured Brazil, but disputes as to the exact determination of the line were frequent. A treaty was negotiated on April 22, 1529, at Saragossa, fixing the demarcation line 297½ leagues east of the Molucca Islands, but this arrangement was abrogated by subsequent treaties. France, England and the Netherlands, the principal colonizers of North America, paid little attention to the Papal bull.

DE MILLE, JAMES (1833-1880), a Canadian educator and novelist, the writer of more than thirty books of fiction. Among the best of these are *Helena's Household,* a story of Rome in the first century of the Christian Era, and *A Strange Manuscript Found in a Copper Cylinder,* published after his death. *Andy O'Hara; The Soldier and the Spy; Comedy of Terrors,* and *The Dodge Club* are others of his books. De Mille was born at Saint John, N. B., was graduated from Brown University in 1854, was professor of the classics in Acadia

College (now University) from 1860 to 1865, and thereafter until his death was professor of rhetoric and history in Dalhousie University.

DEMOCRAT'IC PARTY, officially known from the time of Washington's second administration as the Democratic-Republican party, and after 1829 as the Democratic party. It is the oldest political organization in the United States, and has been inspired by the political principles laid down by Thomas Jefferson practically since the foundation of the Federal government.

Its Origin. All men were united in their effort to establish order following the trying days of the Revolution. On the question of adoption of the Federal Constitution public opinion was divided: one group, led by Alexander Hamilton, advocated its acceptance by the states without alteration; another group declared against such centralization of power as the Constitution threatened to impose upon the country, and maintained that the states should be invested with almost sovereign authority, to assure local self-government. The champions of the Constitution won, but the opposition obtained a promise that Congress, as one of its first acts, should propose a series of constitutional amendments guaranteeing certain inalienable rights to the people. Hamilton and other spokesmen for the Constitution, in the form in which it was passed by the Convention, became known as the Federalists. The natural designation of the opposition, headed by Thomas Jefferson, was Anti-Federalist, and this party was in every essential respect the beginning of the present Democratic organization.

Its Early Development. After the Constitution was adopted the distinction between Federalists and Anti-Federalists became almost meaningless. All men joined in an effort to establish the new government as quickly as possible, and for two or three years party names were lost to view. In 1792, on the eve of the second Presidential election, there arose two active groups, the old Federalist wing becoming known as National Republicans and the followers of Jefferson as Democratic-Republicans. The former were successful in national contests until the year 1800, when the Democratic-Republican party elected Jefferson to the Presidency, and from this time party differences were more marked. All the elements in direct or passive sympathy with old Federalist tenets now aligned themselves with the National Republicans, but the hold of Jefferson and his theories upon the people was so strong that his party was retained in power through the administrations of its leader and the succeeding terms of Madison and Monroe. Chief among Democratic principles was the belief that a large army and navy were unnecessary, but emphasis was also placed on the need for economy in government, on the rights of the states and on the desirability of avoiding foreign complications.

Strict adherence to these principles embarrassed the administrations and displeased the people, for the country was humiliated in a series of international incidents which ultimately led to war with Great Britain. Although it ended successfully and left an "era of good feeling" behind it, the nation was not satisfied and in 1824 elected John Quincy Adams, the candidate of the original Federal element, or National Republican party. In this election, for the first time, Presidential nominations were not exclusively in the hands of a Congressional caucus; Adams was nominated by the state legislatures. The Democrats, largely owing to the unpopularity of the Adams administration, returned to power in 1829, with Andrew Jackson as President. During the succeeding eight years Jackson welded together a party so strong that it has continued to the present day either as the dominant party or as the strongest minority organization.

The Problem of States' Rights. Since the days of Jackson the career of the Democratic party must be divided into two parts. Until after the War of Secession the campaign issue was always concerned with slavery or the tariff, and chiefly as a phase of a greater struggle to determine the relation of the individual state to the United States. South Carolina's nullification doctrine was based on the assumed right of secession (see NULLIFICATION). Although Jackson himself had no sympathy or patience with nullification, his party gradually came into the control of men who were unwilling to interfere with state institutions. Thus it happened that the Democratic party was driven to the defense of slavery.

After the War of Secession. At the close of the War of Secession the Democratic party was in a peculiar position. The Southern Democrats were mostly disqualified from voting and from office-holding by the reconstruction measures (see RECONSTRUCTION); the Northern Democrats, as a party, were unpopular because they had opposed the vigorous prosecution of

the war. The war had ended slavery and had eliminated the threat of secession, but there remained one great issue, the tariff, from the ante-war period. On this issue the Democratic party won its only victories in national elections between 1856 and 1884. During the reconstruction period, the Democrats waged a vigorous fight against the Congressional policy of reconstruction, and later they took issue on financial measures. The inefficiency in the government under Grant gave the Democrats an issue which nearly resulted in the election of Samuel J. Tilden. Civil service reform and lower tariffs were the campaign cries which elected Grover Cleveland in 1884 and 1892, and lower tariff was the chief plank of the Democratic platform in 1912, when Woodrow Wilson was elected.

In 1916 the underlying issue was the personality of the candidates, but the Democratic party practically stood on its record, which the Republicans attacked with vigor. The campaign was notable for the large number of issues which were discussed—among them the Mexican situation, a proposed constitutional amendment to provide national woman suffrage, the threatened railway strike and the Adamson railroad labor law, and most important of all, the government's attitude toward the European nations, especially Germany, whose submarines had been responsible for the death of many Americans.

In still another way, the War of Secession marked a break in Democratic policy. From 1801 until 1861 the Democrats had been successful in every Presidential election except three. Tyler, moreover, who had been elected with Harrison on the Whig ticket, turned out to be more of a Democrat than a Whig. Before the war the Democratic was the majority party. It was essentially conservative, unwilling to advocate new doctrines; these were left to the Whigs, the Free-Soilers and the Republicans. After the war, the Democratic was a minority party; it had to march to the attack, and in consequence it gradually became more progressive, while the Republican party in its doctrines was more inclined to conservatism. Contrary to the known fact that the responsibilities of office make for conservatism, the progressive tendency of the Democratic party became more strongly marked after its return to power in 1913. This condition was generally attributed to the lesson [illegible]t by the formation of the Progressive [illegible]n 1912. The Democratic leaders realized the forward-looking tendency of the times, and set their course accordingly. See, also, POLITICAL PARTIES IN THE UNITED STATES; UNITED STATES, subtitle *History*. W.F.Z.

Consult Johnston's *American Politics;* Woodburn's *Political Parties and Party Problems in the United States.*

DEMONOLOGY, *de mon ol' o ji,* the belief in the existence of demons, commonly in the sense of *evil spirits.* The belief was elaborated in medieval times and led to such legends as those of Faust and the Witches' Sabbath. Its discussion is pertinent to the consideration of witchcraft (which see). See FAUST.

Relating to Various Beliefs. The articles on the following topics, while not bearing on demonology, are of interest in this connection.

Alchemy	Palmistry
Astrology	Phrenology
Clairvoyance	Physiognomy
Conjuring	Psychical Research
Divination	Psycho-Analysis
Faith-Cure	Spiritualism
Hypnotism	Subconscious
Magic	Suggestion
Medium	Superstition
Mesmerism	Telepathy
Mind-Reading	Theosophy
Necromancy	Trance
Occult	Witchcraft

DEMOSTHENES, *de mos' the nees* (about 383-322 B.C.), not only the most eloquent orator of antiquity but possibly of all time, and one of the noblest characters in Greek history. He was born in Attica, the son of a wealthy manufacturer who left his property and his children to the care of three guardians who proved unworthy of the trust. When Demosthenes came of age he argued and won his first case in the law courts, a suit against the dishonest guardians. This and other successes made him resolve to enter public life, and to that end he mastered Greek law and politics and the art of oratory. Laboring under

DEMOSTHENES
From a bust in the Vatican, Rome.

disadvantages that would have discouraged the average youth—a harsh and unmusical voice, weak lungs and awkward movements—he made his name a synonym for eloquence by the severest self-discipline. The story is told that he practiced reciting as he climbed steep hills, and defied the roar of the waves upon the seashore to drown out the sound of his voice.

From the time he was twenty-five until his death Demosthenes gave himself with unselfish devotion to the cause of Greek liberty. He saw, as his countrymen did not see, that the weak and disunited Grecian states were doomed to fall a prey to the designs of Philip of Macedon, and he denounced that crafty monarch in a series of harangues, the famous *Philippics*, that have given their name to all modern speeches characterized by bitter invective. In 338 B.C., when Philip led his army through the Pass of Thermopylae and seized the city of Elatea, the orator persuaded the Athenians to form an alliance with Thebes and to fight for the freedom of Greece.

Though the allies suffered a crushing defeat at the Battle of Chaeronea, Demosthenes urged the Athenians not to lose courage and to repair their city walls. When Ctesiphon proposed that the great patriot be awarded a golden crown for his services, he was charged by Aeschines, the rival of Demosthenes, with having made an illegal proposal. To this charge Demosthenes replied with what critics agree in calling the most perfect masterpiece of oratory that has ever been delivered—the oration *On the Crown*. As a result, Aeschines left Athens and went into permanent exile.

On the accession of Alexander the Great to the throne of Macedon, Demosthenes endeavored without success to unite the Greeks against the conqueror. In 324 B.C. he was imprisoned on a false charge of having received a bribe from one of Alexander's generals, but succeeded in making his escape; the following year, on the death of the Macedonian ruler, he returned in triumph to resume his leadership in Grecian affairs. The states of Greece then united against the Macedonian general, Antipater, carrying on with him the so-called Lamian War (323-321 B.C.). The effort was disastrous, and Demosthenes, who had been the very heart of the struggle, preferring death to falling into the hands of Antipater, took his own life by poison. B.M.W.

Consult Wright's *Short History of Greek Literature*; Henderson's *Classic Greek Course in English*.

Related Subjects. The reader is referred to the following articles in these volumes:

Aeschines	Greece, subtitle *History*
Alexander the Great	Philip of Macedon

DEMUR'RER, a written statement, or pleading, in law, in behalf of a defendant, which admits the facts in evidence but denies that such facts are sufficient to maintain the issue or constitute a good cause of action or defense. Demurrers are *general,* where no particular cause is assigned, or *special,* where the particular defects are pointed out. The effect of a demurrer, when allowed, is to put an end to the suit, unless the court gives the plaintiff leave to amend or unless it is confined to only a part of the complaint. In many states it takes the place of a motion for a non-suit or order of dismissal of the suit.

DENARIUS, the name given to a silver coin of the Romans during the period of the empire and the republic. In the former period its obverse bore the heads of the emperors; later, historical and mythological characters were substituted. It was first issued in 269 B.C., and disappeared from circulation in the third century A.D. Its value was ten, and later sixteen, of the coin called *as,* equivalent to about seventeen cents in American or Canadian money. The name also applies to a small gold coin struck during the days of the empire, and to one of copper issued in A.D. 296 by the Emperor Diocletian. This latter is the penny of the New Testament.

DENARIUS OF CAESAR

DENA'TURED ALCOHOL. See ALCOHOL, subhead *Denatured Alcohol.*

DEN'ISON, TEX., a city of Grayson County, in the northeastern part of the state, two and one-half miles south of the Red River, the Oklahoma-Texas boundary line. Dallas is seventy-four miles southwest, and Oklahoma City is 192 miles northwest. Denison is on the main lines of the Missouri, Kansas & Texas and the Saint Louis & San Francisco railways, and is the terminus of divisions of the Missouri, Oklahoma & Gulf, the Texas & Pacific, the Houston & Texas Central and the Southern Pacific railroads. The Texas Traction Company operates an electric line from Denison south to Waco, through Fort Worth and Dallas. The population of the city was 13,632 in 1910 and 14,779 in 1916. The area is over four square miles.

Denison is the commercial center of a large agricultural region. It is on the northern border of the great cotton belt. Cotton and cottonseed-oil factories, flouring and peanut mills, creosote works, grain elevators and a mattress and felt factory constitute the chief manufacturing enterprises. There are large locomotive and machine shops of four railway systems.

The Federal building, erected in 1909 at a cost of $175,000, a $250,000 union depot, a city hospital, the public library (provided by the Women's Club), a $125,000 high school, banks and hotels are among the important buildings. Denison is the seat of Saint Xavier's Academy (Roman Catholic). Forest Park and Playground, of sixteen acres, and Munson's Park, of 125 acres, are the city's recreation spots.

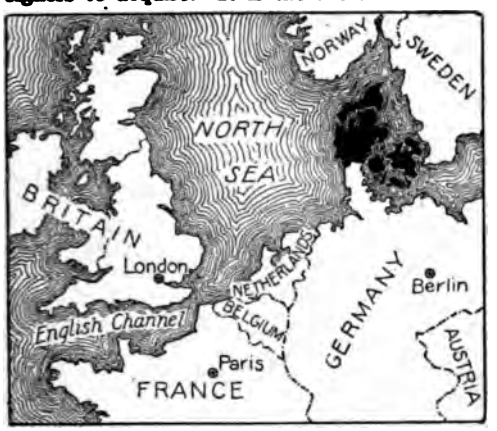
The early newspapers of the Southwest were the first to refer to Denison as the *Gate City*, for through it passed the pioneers who settled Texas. It was the first Texas city south of the Red River and was for many years a typical border town. The Missouri, Kansas & Texas Railroad was completed to this point in 1873, the year in which the city was founded, and the place was named for George Denison, a director of that road. It received a city charter in 1891, and in 1905 adopted the commission form of government. W.N.K.

DENISON, George Taylor (1839-), one of Canada's most patriotic citizens, well known as a writer on military history and tactics. He was born in Toronto and received his education at Upper Canada College and the University of Toronto. He was called to the bar in 1861 and engaged in active practice for a number of years. He served for forty-four years in the Canadian militia, becoming lieutenant-colonel in 1866 and honorary colonel in 1907. He took an active part in suppressing the Fenian raid in 1866 and the Riel Rebellion in Saskatchewan in 1885. In 1877 he won the grand prize offered by the Emperor of Russia for the best work on the *History of Cavalry*. This book has been translated into several languages, and is accepted as an authority on modern strategy. He also wrote a *Manual of Outpost Duties*, *Soldiering in Canada* and *The Struggle for Imperial Unity*. He has been president of the British Empire League in Canada since its organization in 1896, and has contributed to British and Canadian magazines frequent articles on the relationship between the colonies and the mother country. Colonel Denison has taken an active interest in the work of many literary and historical societies, has served a term as president of the Royal Society of Canada, and has been police magistrate in Toronto since 1877. G.H.L.

DENMARK, a north-central peninsula-and-island kingdom of Europe, the smallest of the three Scandinavian kingdoms. The Baltic Sea, the Sound and the Cattegat separate it from Sweden on the East; the Skagerrak lies between it and Norway on the north; and across the North Sea lies Great Britain on the west. On the southern boundary, along less than forty miles, lies Schleswig-Holstein, formerly a portion of Denmark, but now a part of the German Empire. Comprising the Jutland peninsula, the Danish archipelago east of the peninsula, the island of Bornholm farther east and south of Sweden, and the Faroe Islands north of Scotland, the kingdom of Denmark covers an area of 15,582 square miles, almost twice the area of the state of New Jersey, but the population does not quite equal that of the same state. It is only about one-eighth the size of its neighbor, Norway; still its population of 2,775,076 is almost as great as that of the larger country. Its lands support in prosperity and contentment 178 people to the square mile, nine times Norway's average.

The People, Their Language and Religion. Descendants of a race of heroes and conquerors, the Vikings of history and literature, the Danes are a Teutonic people, with light hair and blue eyes. They are intelligent, industrious and

hospitable. Danes make bold and hardy seamen. Their language is like Swedish and Norwegian, but more soft and rather monotonous, with shades of sound difficult for foreigners to acquire. It is the most modern of



DENMARK (IN BLACK)

Scandinavian languages and is used to a large extent by the educated classes of Norway, where it became the written language through the one-time union of Norway with Denmark. It is written either in German or Roman characters. The established religion of Denmark is Lutheran, but all creeds are tolerated.

Colonies. Besides the territory described, Denmark possesses territories covering an area of about 86,575 square miles, about one-third the area of Texas, with a population of nearly 125,000, an average of not even two to each square mile.

Iceland, the most thickly-populated, but second in size, of Denmark's colonies, came under the crown of Denmark in 1280, and although it was lost to England during the Napoleonic wars, was under direct Danish rule almost continuously until home rule was granted it in 1874. This island is situated 500 miles northwest of Scotland.

Greenland, the largest island of the world, is the largest of Denmark's colonies and also the most thinly-populated, for it is in an Arctic region, covered deep by the ice that for long ages has accumulated upon its surface. Its southern end is not far from Northern Labrador; its northern extremity lies in unexplored regions. This land of the Eskimo and polar bear is directly under the government of Denmark and became one of that kingdom's possessions during the eighteenth and nineteenth centuries. Its trade is a state monopoly.

Three islands of the West Indies, Saint Croix, Saint Thomas and Saint John, belonged to Denmark until 1917, when by sale they were transferred to the United States for $25,000,000. See WEST INDIES, DANISH.

Physical Features of Denmark. Denmark, islands and mainland, is a part of the Baltic Plain. For the greater part it is built up of the sand tossed up by the sea and blown inland by the winds. From the low, sandy west and northwest coasts of Jutland, the mainland of Denmark, which covers almost half the surface of that peninsula, is a region of fiords and dunes and shallow lagoons, or inclosed bays, which are useless as harbors. But continuing east across the peninsula and throughout the islands of the archipelago are found rather fertile lowlands dotted with ridges of hills. Of especial note is the range of hills across the middle of Jutland, the highest point of which is about 600 feet above sea level.

The eastern coasts, especially of the islands, have several excellent harbors, the most important belonging to Zealand Island, at Copenhagen, the capital of Denmark. Stretching across Jutland from the east are interesting fiords, the most remarkable being the Liimfiord, which, winding in and out, crosses the entire peninsula at the north. The largest islands of Denmark, Zealand and Fiinen, divide the outlet of the Baltic Sea into three belts, from Jutland to Sweden—the Little Belt, the Great Belt and The Sound.

Although there are many streams and lakes in Denmark well stocked with fish, the only river of note is the salmon-stocked Guden, eighty miles long, which is navigable part of its length. About five per cent of the area of Denmark is forested, beech trees being most abundant. The land surface consists largely of clay and sand, and in the west and north of Jutland are moorlands of peat.

Climate. The land of the sturdy Dane is one of frequent heavy rains and mists, and it has a climate much like that of Eastern Scotland. The average temperature in summer is 60° F., and in winter 32° F.; the annual rainfall ranges between twenty-one and twenty-seven inches. In Jutland sand storms are often experienced, and the climate there is never as mild as on the islands.

Industries. A journey through Denmark shows it to be an agricultural country. Almost everywhere may be seen fields rich with oats, barley, rye, wheat, potatoes and beets, and pastures and meadow lands dotted with grazing

cattle. Eighty per cent of the area of Denmark is productive; six per cent is beech-covered forest land. Nearly forty per cent of the population lives directly by agriculture, and as the law forbids the forming of large estates the number of peasant farmers is large. The progressive Danes believe in coöperation, so expensive machinery and improved methods have been installed through the united efforts of the farmers, and the dairying industry has grown to wonderful proportions. Danish butter is famous even outside of Denmark; more than $50,000,000 worth of butter and almost $12,000,000 worth of eggs are sent each year to England alone. About 30,000 horses and 153,000 heads of cattle are exported yearly.

Although manufacturing industries are growing, the lack of coal has been a handicap to their development. The principal manufactures are furniture, porcelain and wearing apparel. Yet much of the latter is not dependent on power produced by fuel, but comes from the knitting needles of the female population, from tiny girls to their grandmothers. Many peasants also spin and weave in the old-fashioned way.

The royal porcelain works at Copenhagen have a large yearly output of gracefully-designed pottery. Other manufactures include over 160,000 tons of beet sugar and various kinds of machinery. Denmark is the poorest of European countries in mineral resources, no metallic ores being found; the peat bogs of Northern and Western Jutland furnish the most valuable yield.

Fishing is an important industry, herring, turbot, salmon, oysters and seals being the most profitable. The yearly value of Denmark's fisheries is about $5,000,000.

Transportation, Communication and Commerce. The internal traffic of the kingdom is handled over 2,390 miles of railway, more than half of which belongs to the state. There are more than 4,200 miles of good roads and 22,500 miles of by-ways. Plying back and forth between the islands and the mainland, steamers keep up constant intercourse among the various cities, most of which are located on the coast or on navigable waters. There are over 1,000 post offices, nearly 9,000 miles of telegraph wires and about 350,000 miles of telephone wires.

The commerce of Denmark and its colonies, conducted chiefly with Great Britain, Germany, United States, Sweden, Norway and Russia, is handled by over 32,000 vessels. The chief articles of export are animal and dairy products, and the imports include cereals, cotton, iron and textiles.

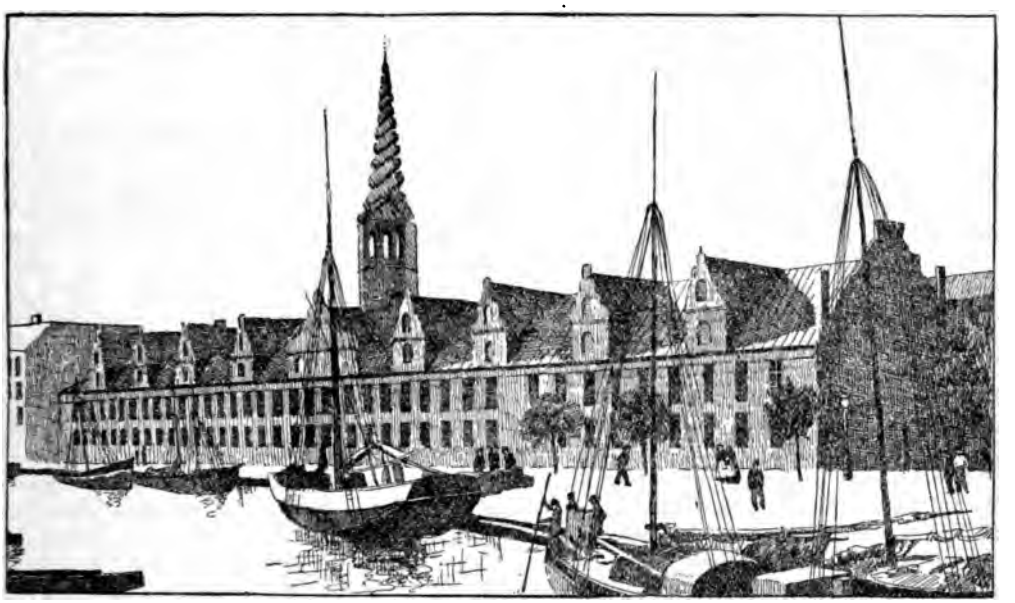
Education. Provisions for public elementary education were made in the beginning of the nineteenth century and in 1814 school attendance for children between the ages of seven and fourteen was made compulsory. The percentage of uneducated people is very low. In over 3,500 public elementary schools and over 150 private schools almost 450,000 children are taught every year. For higher education, besides the University of Copenhagen, which is for both men and women, there are high schools, veterinary, agricultural and art schools, as well as a college of pharmacy and a Polytechnic Institution.

Literature and Art. The earliest literary contributions from Denmark were in Latin, the oldest books dating back to the second half of the twelfth century. The first really literary writings were ballads about heroes, love and historical events, which for centuries had been told and retold before being placed in writing.

The first Danish printing press was set up in 1490, and in 1550 Christian Pedersen printed a translation of the Bible in Danish, thereby doing for the Danish language what Luther did for the German. Although Hans Christian Andersen (1805-1875) is the only Danish writer who has gained a world-wide reputation, a number of others have contributed works whose beauty and strength are acknowledged by those who read and understand the language. Ludwig Holberg (1684-1754) is considered the founder of Danish literature and of the Danish drama. Johannes Ewald (1743-1781) is Denmark's greatest lyric poet, and the influence of the works of the poet and dramatist Adam Oehlenschlager (1779-1850) is felt to this day. Georg Brandes (1842-), critic and literary historian, has introduced into Danish thought and letters more modern European ideals and tendencies than any other man. Among other writers of the nineteenth century are Herman Bang (born 1858) and Edward Brandes (born 1847), the dramatist brother of Georg Brandes.

The greatest sculptor of Denmark was Bertel Thorwaldsen, or Thorvaldsen (1770-1844), the results of whose genius are displayed in the Thorwaldsen Museum at Copenhagen. Among later artists are the painters Marstrand, Carl Block and Otto Bache. Hartmann, Gode and Heiss are the chief Danish composers of music.

Cities. The chief cities of Denmark, with



THE EXCHANGE, COPENHAGEN

The commercial and monetary clearing house of the kingdom. It is one of Denmark's finest ornaments, and a monument to King Christian IV. The tower of the building represents four dragons with their tails twisted together.

populations of over 10,000, are the beautiful capital, Copenhagen, with nearly half a million people; Aarhuus, Odense, Aalborg, Horsens, Randers, Esbjerg, Vejle, Fredericia, Kolding, Helsingor and Svendborg. The most important of these are described under their titles in these volumes.

Government. Denmark is a constitutional monarchy, governed until June 5, 1915, under the constitution of June 5, 1849, with its revision of 1866. Agitation for constitutional reform commenced in 1913, and the adoption of the new constitution in 1915 reduced the political powers of landholders and extended full suffrage to women.

Executive power is vested in the king, who must be a member of the Evangelical Lutheran Church, and in a council of nine ministers. The right to make and amend laws rests with a Parliament or legislative body, called the *Rigsdag,* or *Diet,* acting with the sovereign. The Rigsdag is composed of two houses, the *Landsthing,* or Upper House, and the *Folkething,* or House of Commons. There are sixty-six members in the Landsthing, twelve nominated for life, the rest for terms of eight years. Every citizen over twenty-five years old and a legal resident of his district is eligible to the Landsthing. The Folkething consists of 114 members, elected by popular vote for a term of three years. According to the Constitution every 16,000 people may be represented in the Folkething by one member. Every citizen of good reputation and over twenty-five years old is eligible to membership.

All men and women who have reached their twenty-fifth year, who are not in receipt of public charity and who have lived for one year in the electoral district in which they are listed are allowed to vote.

Members of the Rigsdag receive payment of $2.68 a day, including Sundays and holidays, for the first six months of each session, which commences the first Monday in October, and $1.50 a day for each day thereafter. Free second-class passage on railways is given to them, and they may charge traveling expenses to and from Copenhagen at the beginning and end of the session.

The government must present all money bills first to the Folkething; in other respects the houses have equal powers. Every four years the Landsthing appoints from its membership four judges, who with others form the *Rigsret,* a tribunal which tries parliamentary impeachments. The nine ministers may speak in either house, but may vote only in the one in which they are members.

For the purpose of local government Denmark is divided into eighteen counties, or *amter,* each *amt* having a governor, or *amtmand.* The counties are divided into hundreds, or

herreder, and they in turn are divided into parishes. In the towns there is a mayor appointed by the government, the larger cities also having boards of aldermen. Copenhagen, the capital, has its own special form of government.

The percentage of crime in Denmark is very small, there being fewer than 900 prisoners in the penitentiaries.

History. The early inhabitants of the mainland of Denmark were those warlike Germans, the Cimbri. They were overcome by Angles, Saxons and Jutes, and when the latter tribes invaded England the Danes of the island of Zealand entered the Continent and by reason of their adventurous spirit soon made their presence felt throughout Europe. The tales of Vikings are many and interesting. From the eighth century Danish kings were heard of, but the first prominent one was Svend I (about 985). He was followed by his son, the great King Canute, who conquered England, and during those reigns the Danes were converted to Christianity.

After Canute's death in 1035 there was much internal dissension and loss of possessions, but from 1157 to 1241, under Valdemar I, Canute VI and Valdemar II, Danish conquests again extended Denmark's power into other lands. After that, again in the hands of weak rulers, the country lost power and prestige. Finally, however, from 1375 to 1412, under the rule of Margaret, daughter of Valdemar IV, the country was given a strong government, and by the Union of Kalmar in 1397, Denmark, Norway and Sweden were united under her sovereignty. She appointed her nephew Eric as her heir. He had none of her great qualities, however, and he undid much of her excellent work. Tired of misrule, in 1448 the Danes chose Christian I as king and he became the founder of the royal family of Oldenburg, which ruled until 1863, a period of 415 years. Christian was also chosen ruler of Schleswig and Holstein, and so kings of Denmark received recognition in the German parliament.

Christian II took the throne in 1513, but his tyranny resulted in the loss of Sweden, that country gaining its freedom under Gustavus Vasa (see GUSTAVUS); it was never again united to Denmark. The cruelties of Christian II cost him the throne in 1523, and his uncle Frederick I was chosen king, ruling for ten years. During the reign of his successor, Christian III, Protestantism was established. During the sixteenth century Denmark began to have a part in European affairs, and during the reign of Frederick II (1559-1588) it was the mistress of the northern seas. Christian IV (1588-1648), one of the most able rulers of Denmark, took part in the Thirty Years' War (which see).

Until 1660 choice of a king was by election, and so the power of the nobles grew while the peasants were oppressed; through the resulting internal unrest the power of Denmark weakened. In 1660, however, Frederick III succeeded in having the kingship declared hereditary in his family; the power of the nobility was lessened, and many improvements in administration were introduced. Not until the rule of Christian VII (1776-1808), however, was serfdom abolished.

Through its relations with Napoleon, Denmark became involved in war with Sweden, England, Russia and Prussia, thereby losing its fleet to England in 1807 and being forced in 1814 to cede Norway to Sweden. Soon trouble started with Denmark's German subjects in Holstein and Schleswig. Rebellion and discontent were put down and held in check for a number of years, but finally Prussia and Austria determined to unite in settling the Schleswig-Holstein matter, and in 1864 war was begun in Denmark. As a result, Schleswig-Holstein passed into the hands of Prussia.

Of late years, one of the most important events in Danish history has been the necessity of granting a constitutional government to Iceland, and in 1904 a special minister for Iceland was created, to reside at Reykjavik. Through the marriage of children of Christian IX into many reigning families of Europe, during the latter half of the nineteenth century Denmark came into very close relationship with many European powers; during his later years Christian IX was called the "father-in-law of Europe." At his death in 1906 his son Frederick VIII succeeded him. For six years the latter was a democratic and popular ruler; his sudden death raised his son to the throne as Christian X.

Other Items of Interest. Denmark raises more wheat to the acre than any other country in the world, its average yield being 47.2 bushels.

Rates on the government-owned railroads of Denmark are astonishingly low, and if, at times, the trains are distressingly slow, this is compensated for in a measure by a total absence of accidents.

Conditions in Denmark may be summed up

OUTLINE AND QUESTIONS ON DENMARK

Outline

I. Location and Character

(1) Relation to other countries
(2) Neighboring bodies of water
(3) Peninsula of Jutland
(4) Islands
(5) Size

II. Physical Features

(1) Baltic plain
  (a) A sandy, wind-built country
(2) Fiords
(3) Heights of land
(4) Denmark's only river
(5) Forest area
(6) Climate

III. The People

(1) Physical and mental characteristics
(2) Language
(3) Literature
(4) Art
(5) Religion
(6) Education

IV. Industries

(1) Predominance of agriculture
  (a) Products
  (b) Coöperative methods
(2) Manufacturing
(3) Fishing

V. Transportation and Commerce

(1) Railways and navigable waterways
(2) Coastwise trade
(3) Articles of export and import

VI. Government and Colonies

(1) Constitutional monarchy
(2) The legislative branch
(3) Local government
(4) Important colonial possessions
  (a) Iceland
  (b) Greenland
  (c) Danish West Indies

VII. History

(1) The Viking era
(2) Canute the Great
(3) The Union of Kalmar
(4) Medieval struggles
(5) Early modern period
(6) Napoleonic era
(7) Recent prosperity

Questions

What part has the wind had in the building of this country?

What is the railway mileage for each hundred square miles of area? For each thousand inhabitants?

What has been the attitude in Denmark toward woman's suffrage?

What did the activities of the country during the Napoleonic wars cost it?

What has Denmark long possessed which the United States desired?

How many metals are produced on the peninsula and islands?

Which city of Denmark figured in one of the most famous literary works ever produced?

What relation does the country bear to the largest island in the world?

Why have manufactures developed so slowly? How are some of them still carried on?

What world-famous sculptor has the country produced?

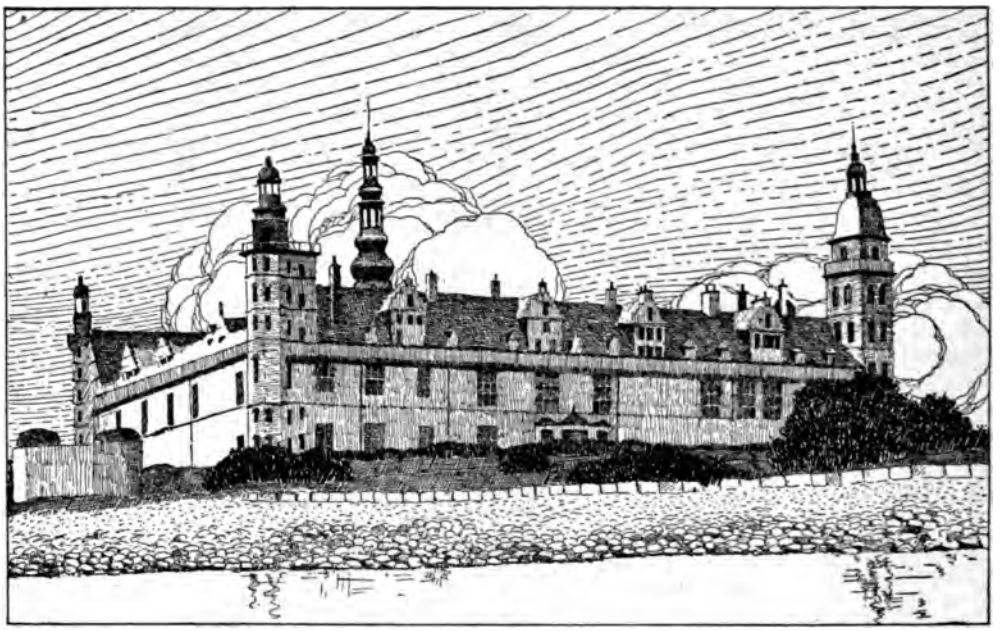
When, besides in the Viking era, was Denmark a "mistress of the seas"?

Which is the most thickly settled of Denmark's colonial possessions?

What principle have Danish farmers introduced which has made possible remarkable agricultural development?

What famous writer made the world familiar with many picturesque phases of Danish life?

Who was Denmark's great queen and what did she accomplish?



KRONBORG CASTLE, SCENE OF THE TRAGEDY OF HAMLET

Here, or it may have been in the grounds of the predecessor of this castle of the Middle Ages, occurred the scenes immortalized in Shakespeare's tragedy of *Hamlet*. The castle is on the little island of Elsinore, off the northern coast of Denmark, and within sight of the shores of Sweden. In the stormy times of long ago it was both a fortress and residence of the Vikings, and within its walls is the tomb of Holger Danska, the founder of Denmark. The story of Hamlet came out of the dawn of the thirteenth century, and although Ophelia's name did not appear in the early version, yet tradition has fixed upon the sequestered spot in the castle ground where she was buried. The scenes of the tragedy and the grave of Hamlet are pointed out to tourists.

in the saying that "Few have too little, still fewer too much."

A tiny headland off an island in the Liimfiord is looked upon by careful authorities as the possible burial place of Hamlet, though residents of Copenhagen insist that he is buried at Helsingör, or Elsinore, in their neighborhood. A traveler tells that he asked a Dane at Helsingör where Hamlet's grave was to be found, and was told that it was never built up until early spring, so that it might be fresh for the American and English tourists to chip up and carry away as souvenirs.

Denmark has 66.2 per cent of its land under cultivation, as against 15.4 per cent in the United States and .8 per cent in Canada.

Each year the United States imports hundreds of thousands of dollars' worth of pebbles for grinding ore and minerals, and the best of these pebbles come from Denmark. In recent years, too, the largest importation has been from that country.

Coöperative dairying and farming have worked wonders for the agricultural class in Denmark. Through this system the peasant farmer, with his few acres and three or four cows, is assured a market as positively as is the owner of large interests, and anything like a monopoly is made impossible.

Practically all the Danish farmers to-day own the land which they farm, whereas at the beginning of the nineteenth century most of them were serfs. Nothing illustrates better than this the progressive character of the people.

The cottage in which Hans Christian Andersen was born and spent his early youth is still to be seen in Odense.

Consult Harvey and Repplen's *Denmark and the Danes;* Thomas's *Denmark, Past and Present.*

Related Subjects. The following articles in these volumes will add to the general information on Denmark given above:

CITIES AND TOWNS

Aarhuus
Copenhagen
Odense

HISTORY

Canute
Christian
Cimbri
Frederick VIII
Hamlet
Northmen
Schleswig-Holstein

ISLANDS

Faroe
Greenland
Iceland
Saint Thomas
West Indies, Danish
Zealand

PRODUCTS AND INDUSTRIES

Agriculture — Egg
Butter — Wheat
Dairying

UNCLASSIFIED

Andersen, Hans Christian — Flord
Brandes, Georg — Jutland
Coöperation — Thorwaldsen, Bertel

DENOM'INATE NUMBERS. There are standard units of measure used in industrial, commercial and scientific life. These units are tabulated in groups which are called the *tables of denominate numbers.*

Any number of the units of measure is called a *denominate number;* for example, 7 feet, 4 dollars, 17 gallons. A denominate number which is expressed in terms of two or more units of the same kind is called a compound denominate number; as, 3 pounds, 5 ounces; 4 feet, 6 inches.

Tables of Money. The following tables show the values of various important money units:

Table of United States Money

10 mills = 1 cent (ct.)
10 cents = 1 dime (d.)
10 dimes = 1 dollar ($)
10 dollars = 1 eagle

The dollar is the standard of value in the United States, and is divided into tenths (dimes), hundredths (cents), thousandths (mills).

Table of English Money

4 farthings = 1 penny (d.)
12 pence = 1 shilling (s.)
20 shillings = 1 pound (£)
21 shillings = 1 guinea

The old English penny corresponded to a coin used on the European continent, called *denarius,* hence the abbreviation "d" for penny. The penny equals about two cents. The pound sterling was, in the seventh century, a pound Troy in silver, hence its name. To-day its weight would be about one-third of its old weight, but there is no coin of that denomination now.

Table of Equivalent Values

COUNTRY	STANDARD	EQUIVALENT IN U. S. MONEY
United States	Dollar	$1
Great Britain	Pound (Sterling)	4.8665
France	Franc	0.193
Germany	Mark	0.238
Austria-Hungary	Crown	0.203
Italy	Lira	0.193
Greece	Drachma	0.193
Spain	Peseta	0.193
Russia	Ruble	0.772

We think ordinarily of a pound (£) as $5; a franc, a lira, a drachma, a peseta as $.20; a mark, a shilling as $.25.

1 franc = 100 centimes (c.)
1 mark = 100 pfennigs (pfs.)
1 ruble = 100 copecs (c.)
1 crown = 100 heller
1 lira = 100 centesimi

Tables of Length, Surface and Volume. Below are several important tables giving values of units used in measuring distances, surfaces, etc. In measuring distance or length, the standard unit is the yard, and the table is called the *Table of Linear Measure:*

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards = 1 rod (rd.)
16½ feet = 1 rod
320 rods = 1 mile (mi.)
5280 feet = 1 mile

The student taking up this subject should do much measuring inside and out-of-doors, getting real knowledge of the measures, not mere words. The home can be of much help to the school here because of the freedom possible in the house, yard, farm, etc. The school should ask for returns from measurements made at home.

From the linear table follows the table of square or surface measure; this is derived by building a square in each linear unit from inch through to rod.

Table of Common Surface Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

The illustration at the right (Fig. 1) represents a square built on an inch; that is, one square inch. It is clear that a square built on ½ inch is ¼ of a square inch.

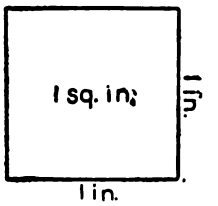


FIG. 1

The following (Fig. 2) represents a square built on a foot, divided into inches; that is, a square foot divided into square inches.

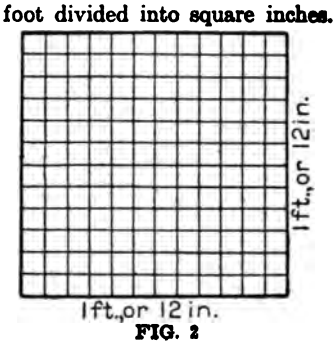


FIG. 2

Fig. 3 represents a square built on one yard; that is, a square yard, or nine square feet.

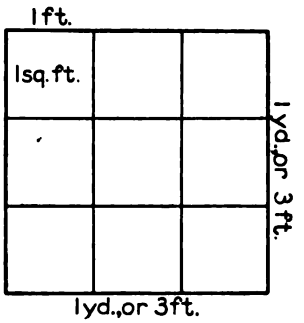


FIG. 3

Table of Surveyor's Linear Measure

7.92 inches = 1 link (li.)
100 links = 1 chain (ch.)
80 chains = 1 mile (mi.)

Surveyor's Surface Measure

625 square links (sq. li.) = 1 square rod (sq. rd.)
16 square rods = 1 square chain (sq. ch.)
10 square chains = 1 acre (A.)
640 acres (a section) = 1 square mile (sq. mi.)
36 square miles = 1 township (Tp.)

The acre is not a square unit of measure as the square inch, square foot and so on; the name *acre* has been applied to a definite amount of ground, namely, 160 square rods, regardless of the shape of the piece of ground. An acre may be 16 rods long and 10 rods wide, or 8 rods by 20 rods, etc., as shown below (Fig. 4).

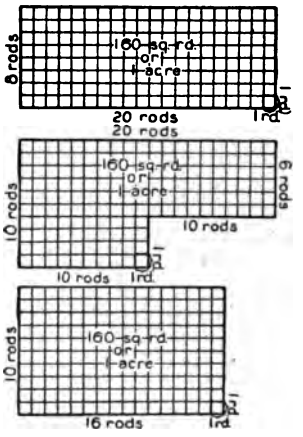


FIG. 4

Notice that there is no linear measure corresponding to acre.

Table of Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

How many cubic-inch blocks can be laid on one square foot of surface? (See Fig. 5.) Count and see. The number is 144. How

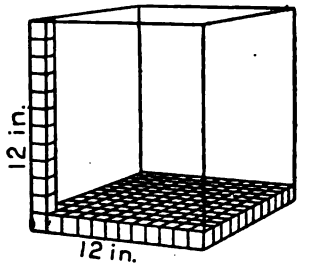


FIG. 5

many layers, each containing 144 cubic-inch blocks, can be piled up in a pile 12 inches high? How many cubic inches in a cubic foot?

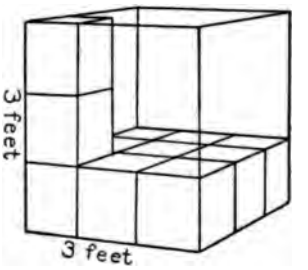


FIG. 6

Examine Fig. 6. How many cubic-foot blocks in the first layer? How many layers in the cubic yard? How many cubic feet in a cubic yard?

Cubic Measures Used in Industries

1 cubic yard = 1 load
128 cubic feet = 1 cord
24¾ cubic feet = 1 perch

One load is the unit of measure for earth removed in excavating. One cord is the unit used in measuring fire wood; a pile of this wood 8 feet by 4 feet by 4 feet is called a *cord*. One cord foot is a pile 1 foot by 4 feet by 4 feet. One perch is the unit used in measuring stone; it is 1 foot by 1½ feet by 16½ feet, or contains 24¾ cubic feet.

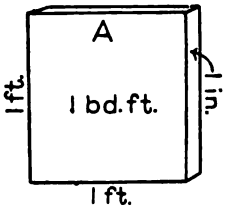


FIG. 7

Board Measure. One board foot is generally the unit of measure for lumber, boards, tim-

bers, joists, etc. The board foot is 1 foot long, 1 foot wide and 1 inch thick (see Fig. 7).

When lumber is less than one inch thick it is counted as one inch thick. If it is over one inch thick, the thickness is considered.

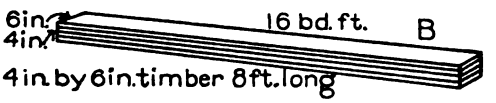


FIG. 8

The above timber (Fig. 8) contains 4 layers each 1 inch thick, with a surface 8 feet by 6 inches. Each layer contains 4 board feet; the timber contains 16 board feet.

A timber is 18 feet long, 8 inches wide and 6 inches thick. How many board feet in it?

Number of board feet=

$$\frac{(18\times\overset{1}{\cancel{12}})\times\overset{4}{\cancel{8}}\times\overset{1}{\cancel{6}}}{\underset{\underset{\underset{1}{\cancel{2}}}{\cancel{12}}}{\cancel{144}}}=72 \text{ or } 18\times\frac{2}{\cancel{3}}\times\overset{2}{\cancel{6}}=72.$$

Table of Liquid Measure

4	gills (gi.)	=1 pint (pt.)
2	pints	=1 quart (qt.)
4	quarts	=1 gallon (gal.)
31½	gallons	=1 barrel (bbl.)

One liquid gallon occupies 231 cubic inches. One cubic foot holds, roughly, 7½ gallons (Fig. 9).

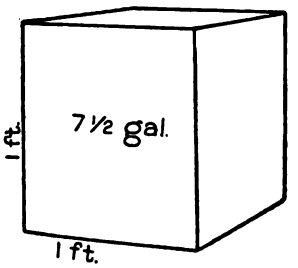


FIG. 9

Table of Dry Measure

2 pints	=1 quart
8 quarts	=1 peck
4 pecks	=1 bushel

The standard of dry measure is the Winchester bushel, a cylinder 18½ inches in diameter and 8 inches deep, whose capacity is 2150.42 cubic inches. A bushel occupies, roughly, 1¼ cubic feet. Fruits and vegetables are now bought and sold largely by weight instead of dry measure.

Tables of Weight Measures. Below are given the tables in common use for the purpose of measuring weights.

Table of Troy Weight

24 grains (gr.)	=1 pennyweight (pwt. or dwt.)
20 pennyweights	=1 ounce (oz.)
12 ounces	=1 pound (lb.)
1 pound Troy	=5760 grains

Table of Avoirdupois Weight

16 ounces (oz.)	=1 pound (lb)
100 pounds	=1 hundredweight (cwt.)
2000 pounds	=1 ton (T.)
2240 pounds	=1 long ton (L. T.)
1 pound avoirdupois	=7000 grains

Table of Apothecaries' Weight

20 grains (gr.)	=1 scruple (℈)
3 scruples	=1 dram (ʒ)
8 drams	=1 ounce (℥)
12 ounces	=1 pound (lb.)

Troy weight is used for weighing gold, silver, platinum, jewels; avoirdupois is used to weigh provisions, as meat, sugar and flour; farm products, as hay, butter, sugar beets, etc.; coal and iron and other commodities. Its name *avoirdupois* (*to have weight*) signifies its use in weighing bulky articles.

The Apothecaries' Table is used by the physician and the druggist. The grain is the unit of comparison among the three tables, being the same in all, while the avoirdupois pound (7000 grains) differs from the Troy and the apothecaries' pound, each of which is 5760 grains. The *grain* which was taken as the unit of the English system of weights was the average of grains "taken from the middle of the ear of wheat and well-dried." The Troy pound is the standard weight in the United States.

Other Tables. The following tables contain several interesting and important units that are made use of every day:

Table for Measuring Paper

24 sheets	=1 quire	2 reams	=1 bundle
20 quires	=1 ream	5 bundles	=1 bale

(Five hundred sheets are now commonly called a ream.)

Table for Counting

12 things	=1 dozen (doz.)
12 dozen	=1 gross
12 gross	=1 great gross
20 things	=1 score

Table for Time Measure

60 seconds (sec.)	=1 minute (min.)
60 minutes	=1 hour (hr.)
24 hours	=1 day (da.)
7 days	=1 week (wk.)
30 days	=1 calendar month (mo.)
12 calendar months	=1 calendar year (yr.)
365 days	=1 common year
366 days	=1 leap year
100 years	=1 century

A mean solar day is the standard unit for measuring time; it is the interval of time from

noon of one day to noon of the next, at a given place, *noon* meaning the moment of the sun's crossing the meridian of that place. The mean solar year is 365 days, 5 hours, 48 minutes, 46 seconds, or nearly 365¼ days. The common year contains 365 days; leap year, 366 days. This is explained fully in the article CALENDAR.

Angular Measurement. In the measurement of angles the most important unit employed is the degree.

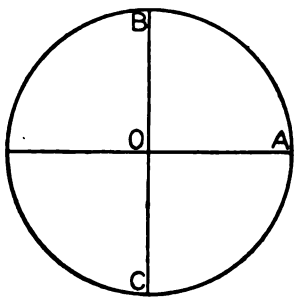


FIG. 10

In Fig. 10 the line OA is perpendicular to the line CB, and the angle AOB is a right angle. This angle is measured by the arc AB, or one-fourth of a circumference, and since every circumference is divided into 360 degrees (360°), it is an angle of 90°. Any angle less than a right angle is measured by less than one-fourth of a circumference, and so is less than 90°. Any angle greater than a right angle is measured by more than one-fourth of a circumference and is more than 90°, as seen below (Fig. 11).

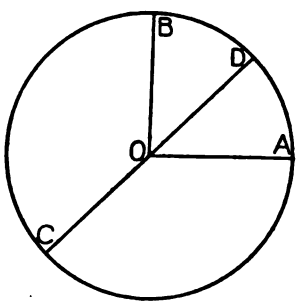


FIG. 11

The angle AOD is an angle of 45°, and AOC is an angle of 135°.

Table of Angular Measure

60 seconds (″)	=1 minute (′)
60 minutes	=1 degree (°)
360 degrees	=4 right angles or 1 circumference

Reduction of Denominate Numbers. The process of reducing denominate numbers to lower denominations or units is called *reduction descending;* as, 6 feet=72 inches. The process of reducing them to higher denominations or units is called *reduction ascending;* as, 16 pints =8 quarts. The latter reduction is used the more often.

Reducing to a lower unit. (1) Express 16 ft. in inches:

Number of inches=16×12=192
or
16 ft.=16×12 in.=192 in.

(2) Change 9 ft. 8 in. to inches.

Number of inches=(9×12)+8=116.

(3) Express in ounces avoirdupois 7 lb. 8 oz.

Number of ounces=(7×16)+8=120.

(4) Express as square inches: 9 sq. ft. 123 sq. in.

Number sq. in.=(9×144)+123=1419
or
9 sq. ft.+123 sq. in.=(9×144) sq. in.+123 sq. in. or 1419 sq. in.

The work is done without names thus:

$$\begin{array}{r} 144 \\ \times 9 \\ \hline 1296 \\ +123 \\ \hline 1419 \end{array}$$

The most desirable form for such problems is that in which the words are at the left-hand side of the equality sign and no words are attached to numbers, as:

Number of sq. in.=(9×144)+123=1419.

(5) Express as seconds, 3 da. 7 hr. 50 min. 8 sec.

Number hr.=(3×24)+7=79.
Number min.=(79×60)+50=4790.
Number sec.=(4790×60)+8=287408.

The work done without names is as follows:

$$\begin{array}{r} 24 \\ \times 3 \\ \hline 72 \\ +7 \\ \hline 79 \end{array} \qquad \begin{array}{r} 79 \\ \times 60 \\ \hline 4740 \\ +50 \\ \hline 4790 \end{array} \qquad \begin{array}{r} 4790 \\ \times 60 \\ \hline 287400 \\ +8 \\ \hline 287408 \end{array}$$

Reducing to higher units. (1) Change to feet (a) 216 in.; (b) 7 ft. 9 in.

(a) Number ft.$=\frac{216}{12}=18$. (b) Number ft.$=7\frac{9}{12}=7\frac{3}{4}$.

(2) Change to pounds avoirdupois (a) 432 oz.; (b) 7 lb. 15 oz.

(a) Number lb.$=\frac{432}{16}=27$. (b) Number lb. $=7\frac{15}{16}$.

(3) Change to higher units 5963 pints.

Number qt. $=\frac{5963}{2}=2981$, and 1 pt.

Number pk. $=\frac{2981}{8}=372$, and 5 qt.

Number bu. $=\frac{372}{4}=93$.

5963 pt. = 93 bu. 5 qt. 1 pt.

It may be done in this concise form:

2|5963
8|2981 + remainder 1
4|372 + remainder 5
93

5963 pt. = 93 bu. 5 qt. 1 pt.

(4) Change 56 cwt. to T.

Number T. $=\frac{56\times100}{2000}=2\frac{4}{5}$

(5) Express in bu. 3 pk. 5 qt. 1 pt.

Number qt. $=5\frac{1}{2}$

Number pk. $=3\frac{5\frac{1}{2}}{8}=3\frac{11}{16}$

Number bu. $=\frac{3\frac{11}{16}}{4}=\frac{59}{64}$

Note—1 pt. = ½ qt., so there are 5½ qt.; it requires 8 qt. to make a pk.; 5½ qt. $=\frac{5\frac{1}{2}}{8}$ of a pk.; multiply numerator and denominator of the complex fraction by 2, thus; $\frac{5\frac{1}{2}\times2}{8\times2}=\frac{11}{16}$. There are 3 pk. and $1\frac{1}{16}$ pk. or $3\frac{1}{16}$ pk., which is $\frac{3\frac{11}{16}}{4}$ of a bu. Reduce fraction by multiplying both terms by 16, thus; $\frac{3\frac{11}{16}\times16}{4\times16}=\frac{59}{64}$.

Addition and Subtraction of Compound Denominate Numbers. In the following paragraphs the principles underlying the addition and subtraction of denominate numbers are explained. *Addition:*

Add:	8 gal.	3 qt.	1 pt.
	1 gal.	2 qt.	3 pt.
Sum:	9 gal.	5 qt.	4 pt.
Reduced sum:	10 gal.	3 qt.	0 pt.

Add at first; then reduce:

4 pt. = 2 qt.
(5 + 2) qt. = 7 qt. = 1 gal. 3 qt.
9 gal. + 1 gal. = 10 gal.

Reduce as you add, as below:

sq. yd.	sq. ft.	sq. in.
6	4	20
2	8	200
9	4	76

Note—Out of 220 sq. in. we get 1 sq. ft. (which is 144 sq. in.), and have left 76 sq. in.; (4 + 8 + 1) sq. ft. = 13 sq. ft.; out of 13 sq. ft. we get 1 sq. yd. (which is 9 sq. ft.) and have left 4 sq. ft.; (6 + 2 + 1) sq. yd. = 9 sq. yd.

Add:

	mo.	da.	hr.	min.
	4	12	18	40
	3	15	12	50
	1	20	25	52
Sum:	8	47	55	142
Reduced sum:	9	19	9	22

(1) Add each set.

(2) Divide 142 by 60 (the number of minutes in an hour), which gives 2 and a remainder 22. This means that 142 minutes = 2 hours and 22 minutes.

(3) Add 2 to 55 and divide 57 by 24 (the number of hours in a day); this division shows there are 2 days and 9 hours in 57 hours.

(4) Add 2 to 47, and divide 49 by 30 (the number of days in 1 month); this division shows there are 1 month and 19 days in 49 days.

(5) Add 1 to 8.

We find the sum to be 9 months 19 days 9 hours 22 minutes. Reduce each set as we go along and get the final answer at once, as below:

gal.	qt.	pt.	gi.
4	3	1	3
1	2	1	2
2	1	1	1
9	0	0	2

Adding the gills we get 6 gills, which equals 1 pint 2 gills. Place 2 gills in gills' place, add 1 pint to the pints, and get 4 pints, which equal 2 quarts and no pints. Add the 2 quarts to the quarts and get 8 quarts, which equal 2 gallons. Add the 2 gallons to the gallons and have 9 gallons. The answer is 9 gallons 0 quarts 0 pints 2 gills.

Subtraction:

(1) A boy weighed on Monday 118 lb. and 7 oz.; on Thursday 116 lb. and 13 oz. What did he lose in the time?

lb.	oz.	lb.	oz.
118	7 =	117	(16 + 7) = 23
116	13 =	116	13
		1	10

Note—We cannot take 13 oz. from 7 oz., so we take 1 lb. from 118 lb. and add it (16 oz.) to 7 oz. and have 23 oz. Subtracting, we have 1 lb. 10 oz.

(2) From a piece of ground containing 78 acres and 90 sq. rd., a piece is sold containing 15 acres and 140 sq. rd. What is left?

acres	sq. rd.	acres	sq. rd.
78	90 =	77	250 (160 + 90)
15	140 =	15	140
		62	110

(3) Subtract the following:

gal.	qt.	pt.	gi.
6	2	1	1
4	3	1	3
1	2	1	2

Note—Change 1 pt. to 4 gi.; then subtract 3 gi. from 5 gi. and have 2 gi. left. Change 1 qt. to 2 pt. and subtract 1 pt., having 1 pt. left; then change 1 gal. to 4 qt. and add that to 1 qt.; from the sum take 3 qt., leaving 2 qt.; finally take 4 gal. from 5 gal. and have 1 gal. left.

Multiplication:

The average weight of the girls in a class of 25 is 86 lb. 9 oz. What do they all weigh?

lb.	oz.
86	9
	25

2150 lb. 225 oz. = 2164 lb. 1 oz.

Multiply 9 ounces by 25 and get 225 ounces; multiply 86 pounds by 25 and get 2150 pounds. Change 225 ounces to pounds by dividing 225 by 16 (the number of ounces in a pound). Find 225 ounces = 14 pounds and 1 ounce, and note that the answer becomes 2164 pounds and 1 ounce.

Division:

yr.	mo.	da.
6 | 3	8	20
	7 mo.	13⅓ da.

Note—3 yr. = 36 mo. 36 mo. + 8 mo. = 44 mo. 44 ÷ 6 = 7 and a remainder of 2. 2 mo. = 60 da. 60 da. + 20 da. = 80 da. 80 ÷ 6 = 13⅓. The answer is 7 mo. and 13⅓ da.

lb.	oz.	lb.	oz. (avoirdupois)
240	12 ÷ 26		12

This division we may carry out in three ways, as follows:

(a) Reduce dividend and divisor to ounces, and divide, as follows:

lb.	oz.	lb.	oz.
240	12 + 26		12 =
	oz.	oz.	
	3852	+ 428	= 9

(b) Reduce both terms to pounds and divide, as follows:

lb.	oz.	lb.	oz.
240	12 ÷ 26		12 =
lb.	lb.		

$$240\frac{3}{4} \div 26\frac{3}{4} = \frac{963}{4} \div \frac{107}{4} = 9$$

(c) Divide as the problem reads; as follows:

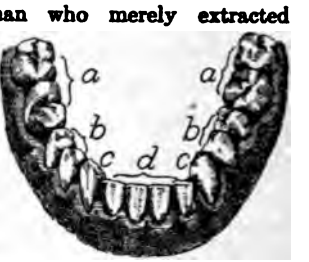
		9	
lb.	oz.	lb.	oz.
26	12	240	12
		240	12

9 × 12 oz. = 108 oz., which equal 6 lb. and 12 oz.
9 × 26 lb. = 234 lb.
234 lb. + 6 lb. = 240 lb. A.H.

DENT, JOHN CHARLES (1841-1887), a Canadian historian whose books are noteworthy for their clear, forceful style and their frank analysis of political history. Dent was of English birth, but when still a child was taken to Ontario by his parents, and was educated in the public schools. He was called to the bar in 1865, but spent most of the next ten years in newspaper work, first in London, England, then in Boston, and lastly in Toronto. Thereafter he devoted himself to historical investigation, his chief works being *The Canadian Portrait Gallery,* a series of biographical sketches; *The Last Forty Years,* a history of Canada between 1841 and 1881; and *The Story of the Upper Canada Rebellion.* Though occasionally marred by prejudices, these volumes in the main are the works of an impartial, conscientious investigator who stated his honest conclusions, and they marked a great advance in Canadian historical writing.

DENTISTRY, *den'tis tri,* that branch of medical science which deals with the teeth and surrounding tissues, and their preservation. The progress made in methods and practice of dentistry has been most marked during comparatively-recent years. For ordinary practical purposes dentistry may be divided into two distinct branches, namely, *surgical,* or operative, and *mechanical,* or prosthetic.

Surgical Dentistry. This branch consists in diagnosing the symptoms shown by the patient's mouth and teeth and in giving required treatment. In grandfather's time a dentist was a man who merely extracted teeth. That conception has been entirely altered, and extraction is now resorted to only in cases of absolute necessity, as for instance, when teeth have been so neglected that treatment would be of no benefit. Modern dentistry demands the saving treatment of teeth. If teeth are naturally overcrowded or irregularly arranged in the mouth, the dental surgeon will endeavor to overcome those defects. If a tooth aches, it is not necessarily an indication that it must be taken out. Careful treatment will relieve the ache caused by the cavity in the tooth, and the cavity will be filled. If the decay has exposed the nerve or the pulp of the tooth, the nerve can be removed and the root canal filled, making it possible to fill the cavity later. Scaling, or the careful removal of tartar accumulated at the base of the teeth, is another important feature, adding to the life of the teeth.



THE ADULT TEETH
(*a*) Molars; (*b*) bicuspids; (*c*) canines; (*d*) incisors.

Preventive Dentistry in Schools. It was long the notion that the state of a child's first teeth was not important; they must drop out anyway, so why trouble about them? But in recent years there has come increased knowledge of the harm which neglected teeth may cause, and as a result preventive dentistry is

being much practiced in connection with the schools. In some cities dentists are paid from the city funds and are thus enabled to devote a large part of their time to correcting the defects in children's teeth, and to instructing them how to care for their teeth, while in other places examinations only are made, and the parents are advised to have their children's teeth attended to. The theory that many a case of dullness in school is directly or indirectly due to bad teeth was scoffed at but a few years ago, but now it is commonly acknowledged. This is a day of prophylaxis, or preventive treatment. Caries, or decay of the teeth, is caused by a germ or organism that lives and reproduces its kind in the grooves and unclean areas of the teeth. It secretes an acid which dissolves the enamel and enters into the dentine, the soft and porous structure of which the tooth is largely made up. Once it starts, decay progresses rapidly. *Clean teeth do not decay.*

Mechanical Dentistry. This includes the branch which deals with making and inserting artificial teeth in place of natural teeth that have been extracted. Dental work of this character requires mechanical skill and careful observation of any peculiarities of the mouth, in order that the teeth inserted may not be unlike the natural teeth in color, size and shape. Artificial teeth are made of porcelain, and may be affixed to plates of vulcanized rubber or to plates of gold or platinum made to fit the gums. Teeth that have been badly broken by decay may be covered with gold and thus restored to usefulness. The practice of crowning teeth with gold is decreasing. A comparatively-recent process, showing a marked advance over older methods of inserting artificial teeth, is known as bridge work. The teeth are fixed by bands, springs or crowns to the natural teeth in the mouth, and last much longer than teeth inserted by any other method.

Painless Dentistry. This phrase once carried little consolation to a patient with aching, sensitive teeth, and was a favorite topic of humorous paragraphers. They intimated that it was painless to the dentist only, which was quite the truth. To-day, however, the dental profession, down to its most inconspicuous members, may actually practice almost painless dentistry.

An ingenious device contains nitrous oxide and oxygen in separate compartments, but when administered to the patient the two gases may be mixed in any proportion. When operative work is done on teeth more oxygen than nitrous oxide is inhaled; the result is absolute absence of pain, but all other senses than feeling are retained; in case of extraction of teeth less oxygen and an added quantity of other gas renders the patient unconscious, with subsequent recollection of only a delightful dream. No ill effects follow its administration; indeed, the presence of oxygen, a stimulating agency, assures the safety of the patient. Dentists are adopting this device rapidly and the dental chair is losing much of its old-time terror.

Another advance was recently made in the introduction into dental practice of what is known as *conductive anesthesia,* or nerve-blocking. This consists in injecting an anesthetic into a nerve controlling the affected tissues, as a result of which the patient ceases to have any sensation whatever in those particular tissues. The effect of the nerve-blocking sometimes lasts two hours, and the method has been found especially valuable in cases where the operation is delicate and tedious, as the extraction of an impacted wisdom tooth. It is also a welcome boon to patients who are high-strung.

Antiquity of Dentistry. It has often been stated that in the days of ancient Egypt it was customary to fill cavities in teeth with gold. Gold has been found in the teeth of mummies, according to some writers. That fact has never been fully established, but that dentistry was practiced in the days of the Pharaohs is undoubted. Many centuries before the Christian Era, gold crowns were worn, bridge work was not unknown, and single artificial teeth were inserted in the place of those newly extracted. Knowledge of the art, however, was lost, and its revival is a matter of modern history.

Dental Schools. For the purpose of giving instruction in dental surgery and mechanical dentistry, schools have been established in many large cities of the world. The first of these schools in America was founded in Baltimore in 1839. A few years later the Ohio College of Dental Surgery was established. Nearly all universities in the United States and Canada now have dental schools and confer degrees on graduated students. The course of study usually embraces four years, during part of which practical experience is gained. A high school course is necessary before admission to any dental school can be obtained. See TEETH.

W.F.L.

DENVER, COLO., popularly known as the *Queen City of the Plains,* the capital and metropolis of Colorado, the county seat of Denver County, and one of the largest cities between the Missouri River and the Pacific coast. It is north and east of the center of the state and is 1,457 miles east of San Francisco, 2,025 miles west of New York City, and 1,050 miles west of Chicago. In 1910 the population was 213,381; in 1916 a Federal estimate gave it 260,800. The area is fifty-eight square miles. Denver is an increasingly-popular summer resort, and it entertains 100,000 visitors annually. The city is on a plain about twelve miles east of the foothills of the Rocky Mountains; the altitude is exactly one mile above sea level. The scenery of the surrounding region is famed for its grandeur. For a distance of 200 miles, from north to south, extends a chain of snow-covered peaks visible from the city. Among these, Long's and Gray's peaks and many others have altitudes exceeding 14,000 feet. The mean annual temperature for July, the hottest month, is 72°, and for January, the coldest month, is 29°. The average annual rainfall is about fourteen inches, and the sun shines 275 days in the year.

The railroads entering Denver have been one of the chief factors in its growth and prosperity. In 1870 a branch line of the Union Pacific was constructed from Cheyenne to Denver, then a city of 4,759 inhabitants. It is now one of the most important railroad centers of the West and is entered by the Union Pacific; Burlington Route; Atchison, Topeka & Santa Fe; Chicago, Rock Island & Pacific; Colorado & Southern; Denver & Rio Grande; Denver, Laramie & Northwestern; Colorado Midland, and the Missouri Pacific railroads. Electric interurban lines extend to Boulder, Golden, Littleton and Aurora. Two small streams, the South Platte River and Cherry Creek, meet in the center of the city.

Parks. All of the parks, which have a combined area of more than 1,000 acres, offer splendid views of the mountains. Many of them contain small lakes; City Park (320 acres), the largest, has a lake, natural history museum, zoölogical garden, aviary and speedway. Washington, Cheesman and Berkeley parks are beautiful spots; Lakeside and Elich's Gardens are attractive amusement resorts. Speer Boulevard is a noteworthy part of an extensive system of drives extending throughout the city. A great number of mountain resorts are easily reached from Denver.

Public Buildings. The capitol, completed in 1895 at a cost of $2,800,000, is constructed of native granite and occupies a conspicuous position on a rise of ground known as Capitol Hill. Its most distinctive feature is a splendid gold-covered dome. Other prominent buildings include the United States Mint, which, with equipment, cost $1,225,000; the county courthouse; Chamber of Commerce; the Auditorium, with a seating capacity of 12,000; a public natatorium, costing $100,000; the old and new Federal buildings, the latter completed in 1916 at a cost of $2,000,000; East Denver High School, the Carnegie Library and the Union Depot. Saint John's Cathedral (Episcopal), the Cathedral of the Immaculate Conception and the Trinity Methodist Episcopal Church are handsome structures. The city has many fine banks, theaters and hotels.

Institutions. Denver is the seat of Denver University, under Methodist control (see DENVER, UNIVERSITY OF). It has also the Jesuit College of the Sacred Heart, Westminster College (Presbyterian), Iliff School of Theology, Colorado Woman's College, Loretto Heights Academy, Miss Wolcott's School and a number of other private schools and schools of dramatic art, music and art. The libraries of the city include a fine public library with five branch organizations, the state library, supreme court library and those owned by the various schools.

The altitude and fine climate of Denver are particularly beneficial in the treatment of tuberculosis, and in the city are a number of splendidly-equipped sanatoriums. One of the best known is the Agnes Memorial Sanatorium.

Among the most important hospitals are Denver County, Saint Luke's and Saint Joseph's.

Industries. The annual output of the smelters of the city is valued at nearly $8,000,000. The smelting of lead, copper, iron, gold, silver, radium, uranium and other ores is one of the principal industries. There are extensive stockyards which annually handle about 1,500,000 head of stock. For the annual live stock show, which is next in size to that held in Chicago, a Stadium has been built of steel and concrete, at a cost of $250,000. There are large slaughtering and meat-packing plants, sugar beet factories, railroad construction and repair shops, foundries and machine shops, and over 800 manufacturing plants which have an annual output valued at $50,000,000. Mining machinery is an important manufactured product. The number of railroads entering the city and the great distance from places of competitive advantages make Denver the largest distributing point of the Rocky Mountain states.

History. Denver was settled by miners in 1852, and was named in honor of General J. W. Denver, governor of Kansas, of which state Colorado was then a part. The city was incorporated the following year by a provisional legislature and was reïncorporated by the first territorial legislature in 1861. It became the capital of the territory in 1867. The town of South Denver was annexed in 1894. H.C.T.

DENVER, UNIVERSITY OF, the oldest institution for higher education in the Rocky Mountain states. It was founded at Denver in 1864 by Governor John Evans, and for the first sixteen years was known as Colorado Seminary. In 1880, when a reorganization took place and the educational work was greatly broadened, the present name was adopted. On the campus at University Park are conducted the college of liberal arts, the graduate school, the summer school and Warren Academy. The professional schools of law, dentistry and commerce, and the teachers' college are located in the heart of the city. Among the buildings at University Park is the Chamberlain Observatory, one of the most important astronomical observatories in the world. The faculty numbers about 130; the student enrollment is over 1,150, and the university library contains nearly 40,000 volumes.

DEPARTMENT, one of the chief territorial and administrative divisions of France, corresponding in some measure to a state of the American Union, or to a province of Canada. When the kingdom was divided into departments at the time of the French Revolution the division was determined by the number of people, amount of direct taxes and extent of territory. This division was effected in 1789, the thirty-four provinces being replaced by eighty-three departments, which were subsequently increased by four after the close of the Franco-German War in 1871. Each department is subdivided into *arrondissements,* or congressional departments, for political purposes; these into *cantons,* or electoral districts; and the cantons into *communes,* or the smallest administrative districts. A *prefect,* appointed by the central government, presides over each department.

DEPART'MENT STORE. Although of comparatively recent development, the modern department store has proved one of the greatest successes of the times from an economical point of view. The creation of such stores was prompted by the unquestioned advantages a person could derive from being able to do all necessary purchasing under one roof instead of being obliged to make a tour of a number of stores.

The modern department store is equipped to meet the needs not only of individuals but of entire families. Not only are necessities such as food provided, but dry goods, clothing, millinery, furniture, hardware and a wide variety of other articles are all to be found, each in a special department which is in itself a complete store. It would be more difficult to mention an article in daily use that could not be obtained at a department store than to enumerate the vast number of things that are daily sold there.

The department store is generally supposed to be entirely an American development, but such is not the case. The same principles were adopted in London in 1863 by William Whiteley, who became known as the "Universal Provider." He added department after department to his original store until his business grew into one of the largest in England. However, the department store has reached its highest stage of efficiency, in organization and in service, in the United States and Canada. The opening of a large department store in one of the most fashionable streets of London in 1909 by a prominent Chicago business man was regarded as an event of great importance in the English business world. Undoubtedly the introduction of more up-to-date methods had a great influence on shopping in London. This influence was quickly seen

in the endeavors of old established conservative firms with few merchandise departments to bring themselves into a position to compete with the new methods. The finest and best-appointed department store in the United States is in Chicago; the most famous stores are in Philadelphia and New York. The best in Canada is in Toronto, and the most renowned in Europe is the Bon Marché in Paris.

Some Results of Department Stores. The opening of department stores called forth a storm of protest from firms in every branch of retail business, which suffered greatly from the innovation. Many small business men were deprived of their livelihood, as no matter what their particular line was, department stores dealt in it and could undersell small retail competitors. From the public point of view the department store might be regarded as an unmixed blessing, but its effects on business generally were often very hurtful. The centralization of merchandising enabled the department store operators to purchase cheaply and to offer big bargains to their customers, but their methods often prevented the small merchant from securing goods at reasonable prices. The result of the competition between department store and small retailer is that many of the latter have been forced into the wage-earning class, preferring to be employed rather than continue a hopeless fight. Most modern department stores are run in direct connection with a large number of factories which supply most goods that are required at the store. On account of quantities handled they can produce cheaply and supply to the customer better articles than the small retailer could obtain, and at lower prices. F.ST. A.

DE PAUW, *de paw'*, **UNIVERSITY,** at Greencastle, Ind., was founded in 1837 by the Indiana Conference of the Methodist Episcopal Church. Until 1884 it was known as the Indiana Asbury University, but in that year the name was changed to De Pauw, in honor of Washington C. De Pauw, whose will provided the institution with a liberal endowment fund, which with other gifts from his family amounted to $600,000. The annual income from all sources is about $90,000. At the present time the university includes the college of liberal arts and a school of music. The faculty numbers over forty, the student body, about 1,000. There are 50,000 volumes in the university library.

DEPEW', CHAUNCEY MITCHELL (1834-), American lawyer, orator and former United States Senator, born in Peekskill, N. Y. He was graduated from Yale College in 1856, immediately took up the study of law in Peekskill and New York City and was admitted to the bar in 1858. He was made attorney and director of the consolidated Hudson River and New York Central railroads in 1869, became general counsel for the Vanderbilt railroad system in 1875 and president of the New York Central Railroad in 1885. The degree of LL.D. was conferred upon him by Yale College the same year. In 1898 he was elected chairman of the board of directors of a number of the largest railroad corporations in the country.

After middle life he had an eventful political career. He figured prominently as a Republican Presidential candidate in 1888, but withdrew in favor of Benjamin Harrison, who after his election tendered Depew the portfolio of the Secretary of State, which he declined. From 1899 to 1911 he was United States Senator from New York. Depew enjoys world-wide fame as an orator, lecturer and after-dinner speaker, and has been sought in these capacities for many years. He has been twice married, first in 1871 to Elise Hegeman, who died in 1893, leaving one son. Miss May Palmer, many years younger than himself, became his wife in 1902.

DE QUINCEY, *de kwin'si*, THOMAS (1785-1859), one of the foremost English essayists, whose most famous work, *The Confessions of an English Opium-Eater,* is unsurpassed as an example of imaginative, rhythmical prose. This is not only a masterpiece of autobiographical writing, but an important contribution to English literature, for it showed what possibilities exist in English prose when it is handled by a writer of extraordinary imaginative power.

THOMAS DE QUINCEY

De Quincey, the son of a wealthy merchant of Manchester, was left fatherless at the age of seven. He was sent to the grammar schools of Bath and Manchester, and at the latter institution was so unhappy that he ran away. After several months of adventure among the hills of Wales and in London, his family found him in a half-starved condition, and sent him

to Worcester College, Oxford. There he remained five years, but was too irregular in his studies to win a degree. During his college career he began to take opium in order to deaden the unbearable pains of neuralgia, and the habit never wholly relaxed its grip on him.

De Quincey left college in 1807, and the following year settled at Grasmere, in the Lake country, to enjoy the companionship of Wordsworth, Coleridge and Southey. In 1821, the year in which his *Confessions* appeared, he removed to London. Having begun to write for the famous Scottish periodical, *Blackwood's Magazine,* he settled in Edinburgh in 1828, and in or near this city resided for the rest of his life.

The greater part of De Quincey's work was published first in periodicals—*Blackwood's, Tait's* and the *London Magazine*. His *Murder Considered as One of the Fine Arts* is a striking example of grim humor; *On the Knocking at the Gate in Macbeth* and *Literary Reminiscences* represent his genius for sympathetic and imaginative criticism. Among other brilliant essays are *The Flight of a Tartar Tribe, Joan of Arc* and *The English Mail Coach.*

DERBY, *der'bi,* a manufacturing town, capital of Derbyshire, in England. It is situated in the beautiful and fertile valley of the Derwent River, 129 miles northwest of London and forty miles northeast of Birmingham. Its position renders it well suited to maintain itself as a commercial center, as it is connected by river, canal and railroad with all parts of England. The city owns all public utilities, which are economically and efficiently worked. The principal manufactures are porcelain, lace, silk and cotton goods. The works of the Midland Railway Company give employment to over 12,000 of the inhabitants. Derby possesses one of the oldest free grammar schools in England, dating from the year 1160. On the opposite side of the Derwent was situated the old Roman village of Derventio. Here many interesting Roman relics, including coins of brass, silver and gold, have been found. In 1745 the Young Pretender, Charles Edward, reached Derby in his attempt to seize the English throne. Population in 1911, 123,433.

DERBY, Conn., a city in New Haven County, in the southwestern part of the state, ten miles west of New Haven. It is on the Housatonic River, at the mouth of the Naugatuck, and on the New York, New Haven & Hartford Railroad and interurban electric lines. The population in 1910 was 8,991; in 1916 it was 9,655. The area of the city is nearly six square miles. Derby and the neighboring towns of Shelton and Ansonia form one of the most important manufacturing centers in the state. The principal manufactures are machinery, brass, iron, paper, guns and ammunition, typewriters, pianos and piano-players, woolen underwear, hosiery, corsets and pins.

Near Derby are Sentinel Hill, Lake Housatonic and Housatonic Dam, which is twenty-five feet high and a quarter of a mile in length. The city has the Griffin Memorial Hospital, a municipal opera house and two public libraries. Settled about 1646 and known as Paugassett until 1675, Derby was then incorporated under its present name, Ansonia being originally a part of it. In 1893 the town of Derby and the borough of Birmingham, connected by a bridge across the Naugatuck River, were organized as a city.

DERBY, Frederick Arthur Stanley, Sixteenth Earl of (1841-1908), a British statesman and colonial administrator, perhaps better known as Baron Stanley of Preston, the title he bore during the years he was Governor-General of Canada. The Stanleys are a family which has been conspicuous in public affairs since the reign of King Henry VII. Edward Stanley, the fourteenth earl (1799-1869), the "Rupert of debate," was a brilliant orator and was three times Prime Minister of Great Britain. His eldest son, Edward Henry Stanley, the fifteenth earl (1826-1893), was also a prominent statesman and was at one time seriously considered as a successor to King Otho of Greece. These men were the father and brother of the sixteenth earl.

It was natural, therefore, for young Stanley to enter politics, and after a brief career in the army he was elected to the House of Commons in 1865. Between 1874 and 1880, in Disraeli's Ministry, he was in turn Financial Secretary of War, Financial Secretary to the Treasury, and Secretary of State for War. He was Secretary for the Colonies in the Salisbury Ministry from 1885 to 1886, and then served for two years as President of the Board of Trade. From 1888 until 1893 he was Governor-General of Canada, a position in which he won great popularity. He had been created Baron Stanley of Preston in 1886, and in 1893, soon after his return to England, succeeded his brother as Earl of Derby. From 1900 to 1903 he was again Financial Secretary to the War Office, and then for two years was Postmaster-General.

DE RESZKE, *de resh'ke,* the family name of two brothers, famous in grand opera. See RESZKE, DE.

DER'VISH, a Persian word meaning *seeking doors,* or *beggar,* is the general term applied to members of Mohammedan religious fraternities who lead solitary, self-denying lives, who solicit alms and are subject to peculiar religious frenzies. Their origin dates back to the earliest days of the Islam faith. There are various orders, or brotherhoods, whose rituals may consist of the repetition of certain prayers or supplications to Allah, of the elaborate whirlings or writhings of the dancing dervishes, or of the frenzied performances of the howling variety, who shriek, mutilate their bodies and swallow hot coals and serpents. They are supposed by the faithful natives to possess miraculous healing and divining powers, and they exercise considerable influence over the lower classes. Whether as fanatics or as fakirs, they contribute an important share to the mysticism of the East.

DESCARTES, *da kahrt',* RENÉ (1596-1650), a celebrated French scholar, whose achievements in philosophy have won him the title "father of modern philosophy," and who is also honored as the inventor of analytical geometry. He was born in the province of Touraine, and was educated at the Jesuit College at La Flèche. There he was regarded as one of the most promising boys in the school, but it is significant that when he left La Flèche, at the age of sixteen, he threw aside his books and endeavored to forget everything he had learned. This was the result of his dissatisfaction with prevailing methods and theories of learning, which made him resolve to keep his mind open to the reception of the truth as it should be presented to him.

In 1617 he entered the army, but, not finding the life of a soldier much of an aid in the search for truth, he abandoned his military career and settled in Holland. In that country he worked out his philosophical system, wrote his most important books and gathered about him a group of disciples. In 1649 he accepted an invitation from Queen Christina to go to Sweden, but died a few months after arriving at her court.

By establishing an original philosophic principle, Descartes began a new era in the history of philosophy. He asserted, first, that, as all existing knowledge rested on an unstable foundation, the first step to take was to doubt everything that could be doubted. He found the only indisputable fact to be his own existence as a doubter and a thinker. That is, he knew that he thought, and therefore could not doubt that he, the thinker, existed. This relation he expressed in the now-famous saying, *Cogito, ergo sum* (I think; therefore I exist).

Beginning with his own self-conscious existence, he reasoned that there were other ideas as clearly and distinctly true as the surety of one's existence; the first of these ideas is that God is the absolutely perfect being. We do not of ourselves originate this idea, because the imperfect cannot originate the perfect, but it is formed in our minds by God himself. The principles thus absolutely and directly known he classified as innate ideas.

The influence of Descartes was as far-reaching on the progress of mathematics as on philosophic thought, and he ranks among the foremost mathematicians of his time. His most important writings include *Essays, Geometry, Discourses on the Method of Reasoning* and *Principles of Philosophy.* B.M.W.

DESERONTO, *des ur on'to,* a town in Hastings County, Ontario, on the Bay of Quinte, an inlet on the north shore of Lake Ontario. It is on the Canadian Northern Railway, and at Napanee, six miles north, has connection with the Grand Trunk. It is 141 miles east of Toronto and twenty-eight miles east of Belleville. It has steamship connection with the chief Canadian and American ports on the Great Lakes and the Saint Lawrence River. The neighborhood produces fruits in abundance, and also supplies lumber, from which the mills and factories of Deseronto make matches, sashes and doors, boxes and cars. A blast furnace and a cannery are also noteworthy. Population in 1911, 2,013; in 1916, about 2,700.

DESERT, *dez'ert,* a region with vegetation insufficient to support human life. It may be hot, like the great Sahara, or cold, like the tundras of Siberia. In the former case lack of rainfall is its cause, in the latter, lack of heat. Rainless regions, however, are deserts according to the usual acceptance of the term. In some instances they exist because mountain ranges lying between them and the ocean from which the prevailing winds blow drain the moisture from all clouds that pass. Sometimes the air may flow into a region of greater warmth; it therefore becomes drier.

Characteristics. A desert is seldom a monotonous, flat waste of barren sand. Much of it is

THE DESERT. Wherever he may be, the Mohammedan prays three times a day, his face towards Mecca. The scene is the Arabian desert. Below, an oasis in Sahara.

rocky or boulder-strewn, some of it is deeply cut by the torrents which follow a burst of rain. The dry sand-bearing wind chisels the rocks into fantastic figures, and forms the surface of the plain in ever-shifting waves and ripples like those of the ocean. Sometimes one of these waves, a traveling *dune,* is a few hundred feet high. Wherever there are springs, or where a near-by mountain causes more frequent rain, there are oases, green islands in the sea of desolation. In the oases of the Sahara date palms flourish naturally, and many kinds of fruit and grain may be cultivated. Some of the oases are only large enough to support one or two people, others will nourish two million.

The animal and vegetable life of the desert is well adapted to its surroundings. The article CAMEL tells how this animal is suited to its arid environment, and the article CACTUS, how that plant thrives in the Great American Desert. The lizards and other small creatures of arid regions, which have no place to hide from enemies, are protected by their imitative coloring (see PROTECTIVE COLORATION). Many of them sleep through the hot summer, or burrow from the sun, and all the animals of the desert have the ability to close their nostrils and eyes to the blowing sand. Even the men of the desert, the wandering Arabs, are able to subsist on less food than more civilized peoples require.

Isaiah's prophecy, "The desert shall rejoice and blossom as the rose," is being fulfilled under modern irrigation. The desert soil when watered is apparently more fertile than that of regions which vegetate naturally, for it becomes virgin soil.

Geography. The greatest desert of the world is the Sahara in Africa, which continues eastward in the Arabian and Central Asian deserts to the Desert of Gobi, reaching nearly to Peking. There are other large deserts in all the continents but Europe. Much of Northern Mexico is arid, and this region extends slightly into the United States, forming what is known in Arizona and adjacent states as the Great American Desert.

Related Subjects. In the following articles will be found additional information bearing on the general topic of deserts:

Arabs	Kalahari Desert
Dune	Oasis
Gobi	Palm
Irrigation	Sahara

DES MOINES, *da moin',* IOWA, the capital and largest city of the state and the county seat of Polk County, is situated near the geographical center of the state, 175 miles west of Davenport, 350 miles west of Chicago and 155 miles east and north of Omaha. Des Moines is on the west and east banks of the Des Moines River, at the mouth of the Raccoon. Both streams are crossed by several good bridges within the city limits. It is served by four interurban lines and by the Chicago, Burlington & Quincy; the Chicago Great Western; the Chicago, Milwaukee & Saint Paul; the Chicago & North Western; the Chicago, Rock Island & Pacific; the Fort Dodge, Des Moines & Southern; the Minneapolis & Saint Louis, and the Wabash railroads. The population, largely American, was 86,368 in 1910 and 101,598 in 1916.

Des Moines covers an area of fifty-four square miles. The business section is along the river, the more attractive residence portion occupying the higher ground in the northwest and northeast sections of the city. The park system covers over 700 acres and includes the grounds (eighty-three acres) of the capitol, and Greenwood, Union, Grand View, Waveland and Riverview parks.

Public Buildings. The state capitol, erected at a cost of about $3,000,000, occupies a prominent position on the east side of the river. It contains the mural painting, *Westward,* by Edwin Blashfield. Other prominent buildings are the United States government building, Polk County courthouse, the municipal building, the post office, built in 1910 at a cost of $500,000, the Iowa Historical building, state arsenal, public library, coliseum, East High School building, Y. W. C. A. and Y. M. C. A. buildings, the Municipal Market House and Mercy Hospital. There are nearly one hundred churches, many of them distinguished for beauty of architecture.

Institutions. Des Moines is the seat of Drake University (non-sectarian), Des Moines College (Baptist), Highland Park College (Presbyterian), Danish Lutheran College, Cumming School of Art, Iowa College of Medicine and Surgery and the College of Osteopathy. A military post was established here by act of Congress in 1910, the land and equipment costing $1,200,000, and this is occupied by a regiment of cavalry. Each fall the state fair held in Des Moines is a festive occasion which brings thousands of visitors to the city.

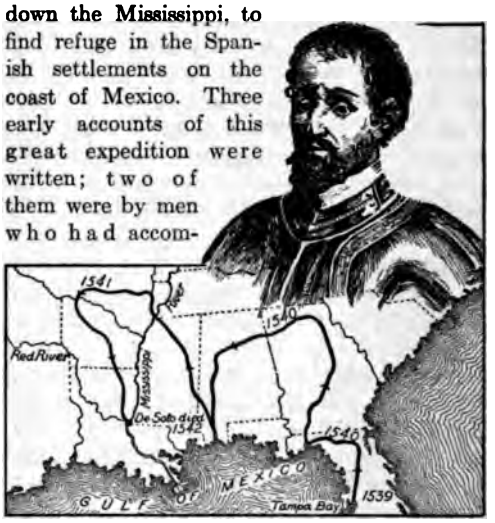
Industry. Mining, manufacture, meat packing and shipping are the chief industries. Rich coal deposits are found in the vicinity of Des

Moines, and nearly 4,000 men are engaged in coal mining. The mines have an annual output of 3,500,000 tons. The manufactures of the city are important and include books and magazines, foundry and machine shop products, structural-iron, engines and boilers, furnaces, agricultural implements, wagons and carriages, harness, axle grease, washing machines, furniture, pottery, brick and tile, sewer pipe, Portland cement, glue, incubators, cotton and woolen goods, clothing, confectionery, crackers, soap, twine, linseed oil, wall paper and patent medicines. The city has extensive wholesale interests and is an important center of the insurance business.

History. The first Fort Des Moines was established here in 1843, and the place was opened for settlement the same year. It was incorporated as a town in 1851 and in 1857 became a city and also the state capital, the seat of government being removed from Iowa City for the sake of a more central location. In 1907 the city adopted a new charter embodying what is known as the "Des Moines Plan." It provides for a ruling council of five, chosen biennially, nominated at a non-partisan primary and voted for on a non-partisan ticket by the electors of the entire city. The city has the power to recall any commissioner and can compel the passage of any law or ordinance. See COMMISSION FORM OF GOVERNMENT.

The name of the city is taken from that of the river, which the Indians named *Moingona*. Trappist monks early visited this country, and the stream came to be the Des Moines, meaning *of the monks*.

DE SOTO, *de so'to,* FERNANDO (1500-1542), a hardy and intrepid Spanish explorer who earned a place for all time in the lists of famous men by his discovery of the Mississippi River. Because of the great hardships involved and treachery of the Indians he lost his life before he could announce to the world his great achievement. After he had become famous and wealthy in the conquest of Peru, De Soto returned to Spain, but was sent to be governor of Cuba and Florida in 1539. No man had previously dared to enter the heart of what is now the Southern United States, but De Soto planned many brilliant adventures in that section when he started out with his company of 600 men. Led astray by false Indian guides through the dense jungles, he lost many of his followers in hostile attacks from the red men. After three years of wandering, De Soto and the few who still lived started back home, but the leader died of fever and was buried in the depths of the great river he had discovered. The survivors built crude boats and floated down the Mississippi, to find refuge in the Spanish settlements on the coast of Mexico. Three early accounts of this great expedition were written; two of them were by men who had accompanied De Soto, the third and most famous by the Inca historian, Garcilazo de la Vega. The latter, however, is little read.



FERNANDO DE SOTO
Portrait of the explorer and map of his route through the Southern United States.

DESTINN, *des'tin,* EMMY (1878-), a Bohemian operatic soprano who has become a general favorite with American audiences. She began her musical education with lessons on the violin, in her native city of Prague, but later commenced training for the operatic stage under the direction of Madame Loewe-Destinn. Substituting her teacher's name for her family name, Kittl, she made as Santuzza (in her debut in 1897 *Cavalleria Rusticana*), at the Royal Opera House, Berlin. Though her success in this rôle established her position as an operatic soprano, she first became widely famous on her appearance as Senta in the initial performance of Wagner's *Flying Dutchman* at Bayreuth (1901).

EMMY DESTINN

Six years later she was invited by Strauss to act the rôle of Salome at the first Paris

production of that opera. The year 1908 marked her first appearance in America, at the New York Metropolitan Opera House. Included in her repertory of over eighty operas are *Aïda, Mignon, Tannhäuser, The Magic Flute, La Boheme, Madame Butterfly* and *The Flying Dutchman,* the soprano rôles of the two latter being her favorite parts. Her voice is also widely known to buyers of phonograph records. She delights in writing and in collecting rare books and beautiful bindings. In 1915 Mlle. Destinn took out her first naturalization papers to become a citizen of the United States. Though under contract to appear in opera in her newly-adopted country for the season 1916-1917, she was detained in Europe by government officials because of the War of the Nations, then in its third year.

DETROIT, MICH., called the *City of the Straits,* on the *Dardanelles of America,* the first city in the state in population, and one of the first ten among the cities of the Union, the county seat of Wayne County and the most important city in the world in the manufacture of automobiles. Within ten miles of the Detroit city hall there are more men who possess scientific knowledge of automobile construction than can be found in any other like area on the globe. The city is situated on the southeastern border of the state, on the Detroit River. This stream is really a strait which connects Lake Erie with Lake Saint Clair and at this point separates the United States from Canada; it forms one of the busiest waterways in the world. Lansing, the state capital, is eighty-eight miles northwest; Toledo, Ohio, is sixty-two miles distant, nearly south; Chicago is 284 miles west and south.

Exceptional transportation service is afforded by the Grand Trunk; the Michigan Central; the New York Central; the Wabash; the Detroit, Toledo & Ironton; the Pere Marquette, and the Canadian Pacific railroads. Passenger and freight steamers connect with all important lake ports, and interurban lines have extensive mileage from the city in various directions west of the river; ferries connect with Windsor, on the Canadian side. In recent years the city has had a marvelous growth, the population of 571,784 by estimate of the Census Bureau in 1916 showing an increase of 106,018 since 1910. In 1917 the city claimed to have reached the rank of the fifth largest American city, with a population of nearly 800,000. Germans and Canadians predominate in a mixed foreign element, which comprises about one-third of the total population. The area of the city is forty-two square miles.

METROPOLITAN DISTRICT

1—Grosse Pointe
2—Hamtramck
3—Greenfield
4—Springwells
5—Ecorse
6—Sandwich
7—Windsor

The dotted line in the river is the international boundary.

Location. The land on which Detroit is built rises gently from the river. This stream, half a mile wide, is fed by the Great Lakes, and affords one of the best harbors on these waters to vessels, even those of the largest size. Along

the river front for several miles the shore is lined with wharves, elevators and warehouses, and here the railroads have located passenger and freight stations. To the north for a distance of about twenty miles lies the Saint Clair Flats, a beautiful residential district, where many wealthy Detroit merchants have built handsome homes. Windsor, across the river, is in reality a suburb of Detroit, and is the terminus of Canadian traffic. Fort Wayne, with its extensive batteries, guards the channel.

Parks and Boulevards. Detroit is one of the most beautiful cities in the Union. Its park reservation of 1,200 acres is divided into twenty-one parks, the most noted of these being Belle Isle (700 acres), an island of great natural beauty on which has been expended $1,500,000. It lies opposite the eastern section of the city and is made accessible by a bridge which was constructed at a cost of $315,000. Its area is to be further increased to the extent of 100 acres by including the southwestern shoals. Here will be erected a fountain for which the late James Scott gave his entire fortune of $500,000. Palmer Park, a forest of 141 acres, has a colonial log house, a colonial casino and a collection of colonial relics. Grand Circus is a semi-circular park of five acres in the heart of the city, from which the streets radiate as from the hub of a wheel; their intersections of streets which run at right angles form a number of triangular parks, some of which are ornamented with beautiful fountains. The Campus Martius is a large plaza between Grand Circus and the river, around which are clustered some of the city's finest public and office buildings. It gives an impression of light and space seldom found in the business district of a large city; the plaza contains the Michigan Soldiers' and Sailors' Monument.

The streets of Detroit are broad and well-shaded, and have a wide reputation for cleanliness. Woodward Avenue performs the double duty of business street and residential boulevard. It begins at the river, and, passing through Grand Circus, the residential district and beyond the limits, divides the city into halves. Griswold Street is the Wall Street of Detroit. There are fine residential districts along Cass Avenue, Boston and Chicago boulevards, in Virginia Park and in Arden Park, but the city's pride rests in Grand Boulevard, which begins at the river on the north and circles about the city to the river on the south.

Buildings. The most conspicuous of the city's buildings is the massive Wayne County courthouse. Others of note are the Federal building, constructed at a cost of $2,500,000; the city hall, facing the Campus Martius, built of sandstone at a cost of $600,000; the handsome new post office; the old post office, now used as the customhouse; the Chamber of Commerce; Detroit Athletic Club House; Masonic Temple; Y. M. C. A. building; the fine passenger station of the Michigan Central Railway; Union Station, and the Majestic, Penobscot, Ford and other office buildings of the most modern "skyscraper" variety. The bank buildings, too, are handsome, up-to-date structures, those of the Detroit Trust Company Union Trust Company, Dime Savings Bank First and Old Detroit National Bank and the People's Bank being especially noteworthy The Detroit Savings Bank is the oldest bank in the state. Of the numerous church buildings the Roman Catholic Cathedral is the largest, but the Church of Saint Anne is the most noted, since the original structure was the first place of worship erected in the city. The First Presbyterian, Fort Street Presbyterian Saint John's, Trinity and Christ (Episcopal) Woodward Avenue Baptist and Central Methodist churches and the Sacred Heart Convent are all structures of unusual architectural beauty.

Institutions. Besides an excellent public school system, the city has Detroit University (opened by the Jesuits in 1877 as Detroit College), Michigan College of Medicine and Surgery, Detroit College of Law and Detroit Homeopathic College. There are nine branches of the central public library, which alone contains 278,000 volumes. The Museum of Art has a fine collection of historic and scientific relics valued at $300,000, including the Scripps gallery and the Stearns collection. The House of Correction, the buildings, grounds and equipment of which cost $600,000, is a widely-known reformatory. Saint Mary's, Red Cross, Herman Kiefer and the United States Marine hospitals are the prominent institutions of this kind, and there are homes for the friendless the aged, the poor and the incurable, and Protestant and Roman Catholic orphanages.

Commerce. Detroit is the gateway for a the commerce between the eastern and western lake ports and for a large part of the railway passenger and freight traffic between Canada and the great Middle West (see SAULT SAINTE MARIE CANAL). The volume of trade an

travel has been further increased by the construction of a new tunnel built under the Detroit River by the Michigan Central Railroad. The chief exports are grain, flour, hogs and hog products, cattle, beef, hides, sheep, wool, cotton, coal, iron and steel products and lumber, although shipments of the last-named have not been so large in recent years as formerly. It also receives either for its own use or for shipment immense quantities of the agricultural and dairy products of the state. Detroit has the largest dry-dock on the Great Lakes. A United States internal revenue office and a department in charge of lake lighthouses are located here. All freighters receive and deliver mail at this point without stopping.

Manufactures. The making of automobiles and their parts is the leading industry. In Detroit is produced more than half of the total output of the United States; in one month of the year 1916 the factory of one low-priced model alone turned out 58,000 cars. At the opening of the season for making 1916 models, 80,000 people were employed in this industry. In the beginning, Detroit was the logical point for the establishment of this great enterprise, as it was largely engaged in the manufacture of marine gasoline engines, and the state was already noted for making fine carriages. But the making of motor vehicles is not the only employment of the people of Detroit, as the city also has extensive manufactures of adding-machines, drugs, chemicals and tobacco products, some of these taking leading rank in the output of the United States. The lumber, tanning and meat-packing industries are also of considerable importance. Here, too, are located one of the most complete shipyards on the Great Lakes and one of the largest seed houses in the world.

History. As early as 1648 this site was visited by Frenchmen, but no permanent settlement was made until 1701. In this year Antoine de la Mothe Cadillac, the first commandant of the French possessions in this locality, built Fort Pontchartrain and garrisoned it with fifty soldiers and fifty colonists. In 1760, at the close of the French and Indian War, Major Robert Rogers seized the place; it suffered frequent attacks by Indians under Pontiac in 1763, but was saved by a heroic defense. In 1778, when the British built Fort Lernoult, there were about 300 inhabitants, the settlement consisting chiefly of log cabins and a Roman Catholic church; the name was changed to Fort Shelby in 1796.

The town was incorporated in 1802, but three years later was almost completely destroyed by fire, only two buildings being left standing. Rebuilding was commenced at once on a large scale, and the new settlement in the same year became the capital of Michigan Territory. It was taken by the British in the War of 1812, and was retaken by the Americans in 1813. Detroit was incorporated as a village in 1815 and as a city in 1824. In 1837 it became the capital of the state and it was the seat of government until the capital was removed to Lansing in 1847. From the time it became a city its growth has been uninterrupted, and its increase in population, wealth, building construction and commerce since 1900 is remarkable. In 1901 the city celebrated the centennial anniversary of its settlement. Detroit is a French word meaning *strait,* hence the popular name, *City of the Straits.* J.B.C.

Consult Farmer's *Historic Towns of the Western States;* Burton's *Cadillac's Village: A History of the Settlement of Detroit.*

DETROIT RIVER, a short river, or strait, connecting Lake Erie and Lake Saint Clair and separating the state of Michigan from the province of Ontario, Canada. It is one of the world's most important commercial highways and carries more tonnage of shipping than any other stream or canal, for all the grain shipped by boat from the great Northwest and all the immense lake shipments of iron ore from Minnesota, Wisconsin and Northern Michigan to the East pass through Detroit River. It is twenty-eight miles long, and its depth is sufficient to permit the passage of the largest vessels afloat. Its breadth varies from one-half mile to three miles. The name is derived from the French *detroit,* meaning *strait.* The scenery along its banks is inviting, and its upper section, called the Saint Clair Flats, is beautiful in spots, being studded with islands which are very popular as summer resorts. A map showing the course of the river appears with the article DETROIT.

DEUCALION, *du ka'li on,* the Noah of Greek mythology, was the mythological son of Prometheus. He and his wife Pyrrha, as faithful servants of the gods, were the only ones saved when Jupiter caused a deluge to destroy the world on account of the wickedness of mankind. In a wooden chest made on the advice of Prometheus, Deucalion and Pyrrha floated on the waters nine days, finally landing on the summit of Mount Parnassus. When the deluge subsided, finding the land depopulated,

they sought the oracle at Delphi for information as to how they could repeople the earth. They were told to throw behind them the bones of their mother. Interpreting that to mean their mother earth, they threw stones over their shoulders, which on striking the earth became men and women, strong and hardy. Deucalion became the ancestor of the Greeks through his son Hellen.

DEUTERONOMY, *du ter on' o mi,* the fifth book of the Old Testament, in which Moses imparted to the Israelites, whom he had led through the Wilderness, the law of their nation. It is therefore known as the *Book of the Law.* These people, most of whom were children when they left Egypt, had traveled nearly forty years and were on the eve of entering Canaan, the Promised Land. Before they crossed the Jordan, Moses gathered them around him in the valley to deliver his farewell address, for God had told him that he could not enter with them because of his disobedience (see MOSES). Moses wished the people to understand the principles of their national law, which was given to their fathers on Mount Sinai. After giving his address, Moses appointed Joshua as his successor to rule the people when they entered the Promised Land. In the last chapter there is a record of Moses' death and burial in the land of Moab. The language of this book is remarkable for its strength and beauty. It is supposed that a portion of Deuteronomy was discovered during the reign of Josiah (*II Kings* XXII, 8).

DEV'IL, also called SATAN, the chief evil spirit, the author of evil and the opposer of God. The word comes from the Greek and means *slanderer* or *false accuser. Satan* in Hebrew means *enemy,* and when used in this sense means the enemy of God and man. But *Satan* as used in *Job* means an *accuser,* and is applied to one of God's messengers who appear before God (*Job* I, 6). In the third chapter of *Genesis* the serpent is represented as the author and introducer of evil to man, and for this reason the Devil is sometimes called the *Serpent.*

All religions recognize one or more evil spirits and acknowledge in their creeds a constant warfare between the good and the evil spirits. In most instances this warfare is moral; but among some peoples disease, suffering and such calamities as famine, hail and flood are attributed to evil spirits, and among the early Christians these were believed to be the work of the Devil. There are doubtless some still who hold to that belief.

There is a distinction between evil spirits and the evil spirit who is the Prince of Darkness; evil spirits are demons—emissaries or aids of the Devil. The devils so often mentioned in the New Testament were demons who possessed certain people, according to popular belief, and whom Christ cast out. This belief in demons among the Jews is similar to the beliefs of the ancient Greeks, Romans and other European peoples in various gods to whom they attributed all sorts of characteristics. The ancient Germans believed in the personality of the evil spirit and had a common proverb, "Where the Devil cannot come he sends his grandmother." Others believe the Devil to be a fallen angel. This is Milton's idea, in *Paradise Lost,* where he says:

> From morn
> To noon he fell, from noon to dewy eve—
> A summer day: and with the setting sun,
> Dropt from the zenith like a falling star.

DEVIL FISH, a name given to various species of sea monsters of weird appearance, often specified as the *angler, sea-devil, toad-fish,* etc. In the United States and Canada the term is applied to the *ray,* a fish of huge proportions, which propels itself in the ocean by flapping its pectoral fins, or sides, up and down. It is occasionally hunted with harpoons for sport. In California the name is sometimes given to the gray whale.

DEVILS LAKE, N. D., the county seat of Ramsey County, is situated on the north shore of Devils Lake, in the northeastern part of the state. It is eighty-nine miles northwest of Grand Forks and 260 miles southwest of Winnipeg, and is served by the Great Northern Railroad, built in 1883, and the Soo Line, built in 1912. The Farmers' Grain and Shipping Company also operates a short line of railroad. The population in 1910 was 5,157.

The city covers an area of about three square miles along the lake. This body of water, with shores crooked and picturesque, is forty miles in length. The surrounding land is a rich agricultural country, and diversified farming and stock raising furnish the city produce for its most important industrial plants, which are creameries and grist mills. Railroad shops of the Great Northern are located here.

Near the town are a number of places of interest, among which are Devils Lake Chautauqua Grounds; Sully's Hill National Park; old Fort Totton, now used as an Indian school;

and the State University Biological Station. Prominent buildings of the city are the Federal building, erected in 1908 at a cost of $150,000; a Carnegie Library, a General Hospital, Mercy Hospital and a Masonic Temple. Devils Lake contains a school for the deaf and Saint Mary's Academy (Roman Catholic).

"Minnewaukan," meaning *Spirit Water,* was the Indian name for Devils Lake. The town, once an Indian village, was settled by white men about 1882. It was incorporated in 1892, and adopted the commission form of government in 1913. A.A.P.

DEVIL WORSHIP, the practice of certain barbarian tribes of Asia, Africa and South America, who worship the Devil on the principle that the powers of evil are as much to be reckoned with as those of good, and must be placated. The Yezidees, or Devil worshipers of Turkish and Russian Armenia and the valley of the Tigris, observe some Christian ceremonies such as infant baptism, and revere the authority of the Old Testament in preference to that of the New Testament or of the Koran. Their worship includes Christ, the Devil, Allah and the sun.

DEVONIAN, *de vo'ni an,* **PERIOD,** or **THE AGE OF FISHES,** was that period of geologic time between the Silurian and the Carboniferous periods of the Paleozoic Era (which see). The rocks formed during the period constitute the *Devonian System,* and these are widely extended, both in America and in Europe. The name *Devonian* is derived from the name given rocks of this period that are common in Devonshire and Cornwall, England. They are chiefly sandstones, limestones and slates containing more or less lime. The Old Red Sandstone is one of the most important formations of the period (see OLD RED SANDSTONE).

North America was divided by the sea into two great land masses, the Eastern, represented by the Appalachian Mountains, and extending southward as far as Georgia and westward as far as the Blue Ridge Mountains, and the Continental, or Western, division, which extended westward from the Hudson River as far as Western New York, Michigan and a part of Ontario. It is also probable that portions of Colorado, the Black Hills in South Dakota, the central part of Texas and a long, narrow strip of land bordered by the great basin in Nevada and Utah were above the sea.

The rocks of the Devonian Period abound in fossils. Among the plants, remains of gigantic horsetails and club mosses are found, foreshadowing the wealth of vegetation which was to follow in the Carboniferous Era. There were shellfish of all descriptions, and in some localities extensive beds of coral. Such sea animals as the star fish, the lobster and the horseshoe crab were common. This was the time when fishes reached a period of high development. For this reason some geologists have named it the *Age of Fishes.* Sharks lived in both salt and fresh water, and other large fishes, some over twenty feet in length, were common. Some of the representatives of the fishes of the time are now seen in the pickerel and the swordfish, but these are smaller than their ancestors of this remote period.

The fossil record of land life shows the existence of snails, insects, myriapods, scorpions and amphibians. W.F.R.

Related Subjects. To connect this period of geologic time with others, and to understand its history more clearly, reference is directed to the following articles in these volumes:

Carboniferous Period	Geology
Fossil	Silurian Period

DEVONSHIRE, *dev'on sheer,* VICTOR CHRISTIAN WILLIAM CAVENDISH, Ninth Duke of (1868-), appointed in 1916 to succeed His Royal Highness, the Duke of Connaught, as Governor-General of the Dominion of Canada. The duke was educated at Eton and at Trinity College, Cambridge, and in 1891 entered the House of Commons as a Liberal-Unionist. He continued to sit in the House until 1908, when he succeeded to the dukedom on the death of his uncle, the eighth Duke of Denvonshire. He was from 1900 to 1903 treasurer of His Majesty's household, and was then for two years financial secretary to the Treasury. He is Lord-Lieutenant of Derbyshire and chancellor of Leeds University. His wife, whom he married in 1892, was Lady Evelyn Fitzmaurice, daughter of the fifth Marquis Landsdowne, who was Governor-General of Canada from 1883 to 1888.

The Duke of Devonshire is one of the great land owners of Great Britain. His estates amount to nearly 190,000 acres, including mineral lands and forests. He owns a valuable library of rare books and an art collection which is world famous. He is an ardent sportsman, particularly fond of hunting, is known as a patron of science, and is regarded as one of the most charming and democratic of the British peers. (See his portrait, in page of Governors-General in the article CANADA.)

The Cavendish Family. The family of Cav-

endish, of which the duke is the chief, has had many distinguished members. The first duke, William Cavendish (1640-1707), was conspicuous in political affairs in the days of Charles II and James II, and was one of the original seven who invited Prince William of Orange to the throne of England. He was created Duke of Devonshire in 1694. The nephew of the third duke was Henry Cavendish (1731-1800), the famous chemist who discovered the composition of water. The fifth duke, William (1748-1811), was the husband of Georgiana, whose beautiful features were portrayed by Gainsborough. The eighth duke, Spencer Cavendish (1833-1908), was better known by his courtesy title of Lord Hartington. He was for years a leader of the Liberals, but after Gladstone's conversion to Home Rule, Hartington led a new party, the Liberal-Unionist. On three occasions he might have become Prime Minister, but each time preferred to yield the honor to another. G.H.L.

DEW. When you go into the garden on a bright summer morning you find drops of water on the grass, leaves and flowers, glistening in the sun. What are they? Where did they come from? First, these tiny sparkling drops are *dew;* second, they come from the air and the ground.

How Dew Is Formed. The atmosphere at all times contains water vapor; the warmer the air becomes the more vapor it usually contains. When the atmosphere cools some of the vapor is condensed and forms water. This is what happens when a pitcher of ice water is set in a warm room; the moisture that collects on the outside of the pitcher is taken from the air that comes in contact with it. Dew is formed in the same way. At night the earth gives back to the atmosphere some of the heat that it absorbed from the sun during the day. Most of this heat passes off through the blades of grass and the leaves of plants, which become cooler than the surrounding air, and they therefore condense the moisture in the same way that the pitcher does.

The largest quantity of dew is formed on a clear, still night, when there is nothing to prevent the radiation of heat or to disturb the atmosphere. The layer of air next to the earth then becomes cooled and gives up its moisture. Wind prevents the formation of dew, because it keeps the atmosphere in motion and there is no chance for it to become cooled by contact with the plants. Clouds often prevent dew, because they reflect the escaping heat back to the earth and prevent sufficient cooling of the plants to enable them to condense the moisture. For the same reason dew is seldom formed under trees or other objects which reflect the heat back to the earth.

Some of the dew on plants rises from the earth in the form of vapor and is condensed the same as that from the atmosphere. Those objects which cool most rapidly collect the most dew. A board, for instance, is a poor radiator and collects but little dew, but large drops may collect on the head of a nail driven into the board. The ground under the board is dry, because there is no chance for the heat to escape from the covered ground. The heaviest dews are in tropical regions, where there is the greatest difference in temperature between day and night. In regions having little rainfall dew is of the greatest value to vegetation. When the temperature is below the freezing point *frost,* instead of dew, is formed. See FROST. C.R.M.

DEWEY, GEORGE (1837-1917), an American naval officer, known as the "hero of Manila," the first American officer after David Porter to be raised to the rank of admiral. His early education was received in his home city, Montpelier, Vt., and at Norwich University. At the age of seventeen he entered the Naval Academy at Annapolis, graduating fifth in his class. In 1865 he received a lieutenant's commission, was assigned to the sloop *Mississippi* under Farragut, and took part in the famous run past the forts that guarded New Orleans. He was commissioned lieutenant-commander in 1865 and served on the *Colorado* and *Kearsarge* for two years. In 1872 he was given command of the *Narragansett* in the Pacific Survey.

ADMIRAL DEWEY

When war was declared between Spain and the United States in 1898, Dewey was in Hongkong in command of the Asiatic squadron, having risen to the rank of commodore. The cable bore him this message: "Proceed at once to the Philippine Islands. Capture or destroy the Spanish fleet." Forty-eight hours later his six vessels, with the *Olympia* at their

head, were steaming toward Manila Bay. On May 1, 1898, he opened fire on the Spanish fleet of ten war vessels and two torpedo boats, and about noon of that day the last Spanish flag had been hauled down and the entire fleet destroyed. Not one American vessel was seriously disabled; not one man had been killed and only seven were injured.

He was soon after appointed admiral by President McKinley; Congress presented him with a sword, and all of his men received medals. On his return to New York in 1899 he received an ovation, and the people of the country, through popular subscription, presented him with a residence in Washington. In 1901 he was president of the Schley court of inquiry and a year later was placed in command of all united squadrons and fleets of the American navy. In 1908 he assumed the presidency of the naval board of strategy. At the time of his death he was the ranking naval officer of the world, by seniority.

DEWEY, JOHN (1859-), a distinguished American educator, philosopher and psychologist, who has attracted wide attention in the educational field by his theory of "immediate empiricism." According to this theory, things are what they are as shown by experience, and knowledge itself is a form of experience. Professor Dewey, in his teaching, makes practical applications of his views, and he belongs to the same school of thought as the distinguished American psychologist William James (which see).

He was born in Vermont and was graduated in 1879 at the University of Vermont, receiving, five years later, a Ph.D. degree from Johns Hopkins University. In 1888-1889 he was professor of philosophy at the University of Minnesota, held a like position at the University of Michigan from 1889 to 1894, and between 1894 and 1904 was director of the School of Education at the University of Chicago. In the latter year he was appointed professor of philosophy in Columbia University. His writings include, besides numerous contributions to periodicals, *Study of Ethics, School and Society, How to Think* and *Influence of Darwin on Philosophy.*

DEX'TRIN, a sticky substance made from starch, which it closely resembles in its chemical composition. Dextrin may be made by adding dried malt to water heated to 70° or 80° F., and then adding starch (the proportions being 10 parts malt to 100 parts starch), heating the mixture to 140° and maintaining this temperature for about twenty minutes, then raising it rapidly to the boiling point. A syrup is formed, which when boiled down forms a solid substance resembling glue. This is dextrin. Dextrin is used for gumming postage stamps, for sticking the colors upon cloth in calico printing, for making varnish and for numerous other purposes.

DIABASE, *di'a base,* a crystalline rock composed of lime-soda, feldspar and pyroxene. The feldspar usually appears in long, flat crystals that radiate from a center like the spokes of a wheel. When the grains of pyroxene are large the rock has a mottled appearance. Some diabase contains olivine in place of pyroxene, and has a green color.

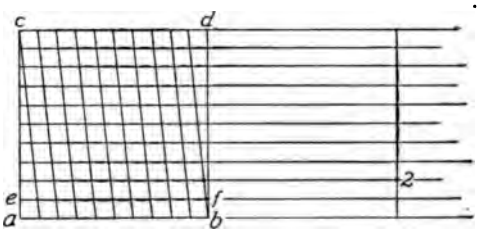
In most diabase the crystals are so small as to give it a massive appearance. It is a hard rock, very heavy and compact. The copper-bearing rock of Keweenaw Peninsula, Michigan, is diabase. Other noted examples are the Palisades on the Hudson River and the Hanging Hills near Meriden, Conn. In many places it occurs in dikes and veins. When it decays it forms depressed soil and boulders. See DIKE; BASALT; FELDSPAR; CRYSTALLINE ROCKS.

DIABETES, *di a be'teez,* the name applied to two types of a certain disease, both of which are characterized by the daily passage of an abnormal quantity of urine. *Diabetes insipidus* attacks children principally, and is a nervous ailment of a not very serious character. Intense thirst and the excretion of an unusual amount of urine are its characteristic symptoms. *Diabetes mellitus* is a serious disease of more common occurrence. A victim of this type of diabetes suffers from continual and intense thirst, dryness of the mouth and lips, loss of appetite, muscular weakness, emaciation, altered sight and in some cases mental disorder, such as indecision and melancholia. Instead of the normal passage of about three pints of urine a day, the diabetic passes from twenty to thirty pints daily. The liver of such a person does not properly carry on its function of transforming starches and sugars during assimilation, and as a result large quantities of liver sugar, resembling grape sugar, make their appearance in the urine. In many cases disease of the pancreas is a feature of diabetes.

Diabetics rarely recover, though some live for many years. In over half the cases death results from coma. Consumption of the lungs is a frequent cause of death; other possible complications are neuritis and paralysis, various

skin diseases, kidney disorders, carbuncles and gangrene. Dieting is the most satisfactory line of treatment, and this must be carried on under the direction of a physician who fully understands the case. The diabetic must not eat foods containing starch and sugar, or any food not readily digested. He must therefore avoid potatoes, turnips, carrots, cauliflower, peas, beans, apples, pears, oranges, gooseberries, plums, peaches, cornflour, white bread, rice, sago, tapioca, candy, pastry and sugar of any kind. Meat, game, poultry, fish, green vegetables, cheese, butter, eggs and nuts are permissible, and in place of white bread he may eat bran or gluten bread. W.A.E.

DIAG'ONAL SCALE, a scale consisting of a system of lines by means of which fractional parts of a unit of measurement may be measured and laid down by compasses. In surveying or laying out maps or plotting land this scale is



DIAGONAL SCALE

of great assistance. The accompanying diagram explains how the scale is used. The space from *a* to *b* represents one inch, and the space from *a* to *c* is also one inch. The square inch contained within *a b* and *a c* is divided into equal spaces by parallel lines. Each small space represents one-hundredth part of a square inch. One-hundredth part of a lineal inch is indicated by the line passing from *d* to *b* at the point where that line intersects the line *ef*. Two one-hundredths of an inch will be found at the intersecting point of the lines above, and so on. If it is required to measure one inch and two one-hundredths of an inch, place one point of the compass at the point marked *2*. The other, being placed at the (.) on the scale, will indicate the two one-hundredths. Each vertical line indicates ten one-hundredths of an inch.

DIALECT, *di'a lekt,* a term used in several closely related senses, but most commonly taken to mean the idiomatic language of a certain district or class, differing from that of other districts or classes, or from the generally accepted literary language (see IDIOM). In early days, before the establishment of easy means of communication and before the invention of printing, people of a certain locality in the course of years might so modify their language that other people, living but a few miles away and using what was originally the same language, could not understand them at all. This was once true in England, and is yet to some extent, although the adoption of a standard literary language has done much toward doing away with the differences, and has made them practically non-existent in the speech of well-educated Englishmen.

Just as Scotch is a dialect of the English language, so English is, or was, a dialect of the Germanic or Teutonic group of languages; but it has changed so radically through the centuries and established itself so firmly that it is never thought of as a dialect. Students of languages find much in the study of dialects which is enlightening, for often through the idioms of differing dialects derivations can be traced and resemblances can be discovered which could not be detected by an examination of a language in the more stable form.

"Dialect stories" are fiction which attempts to gain "local color" by the use of the idiomatic speech of the region with which it deals. Of late years a prejudice has grown up against such fiction, it being regarded as inartistic, and it is true that the method may be carried too far; but many of the best English novels make large use of dialect. They employ the dialect for the sake of the stories, however, instead of making it the excuse for the stories.

DIAMOND, *di'a mund,* a precious stone of wonderful luster and beauty, the most brilliant of all gems and the hardest substance known to man. Bidding defiance to the ravages wrought by time and wear, it holds a supreme place among the jewels, and because of its unconquerable hardness has become figuratively the emblem of fearlessness and invincibility.

Origin. The exact conditions under which diamonds are formed in the earth have not yet been discovered. They were first found in gravel and sands in streams, and later were discovered deep in the earth. Mined diamonds are found in ancient volcanic vents, which seems to indicate that they have been violently blown out of the interior of the earth by volcanic action, or that they have formed under the conditions of cooling lava. Recently, scientists have discovered that by heating pure prepared carbon and iron to intense heat by electricity, then letting the mass cool suddenly,

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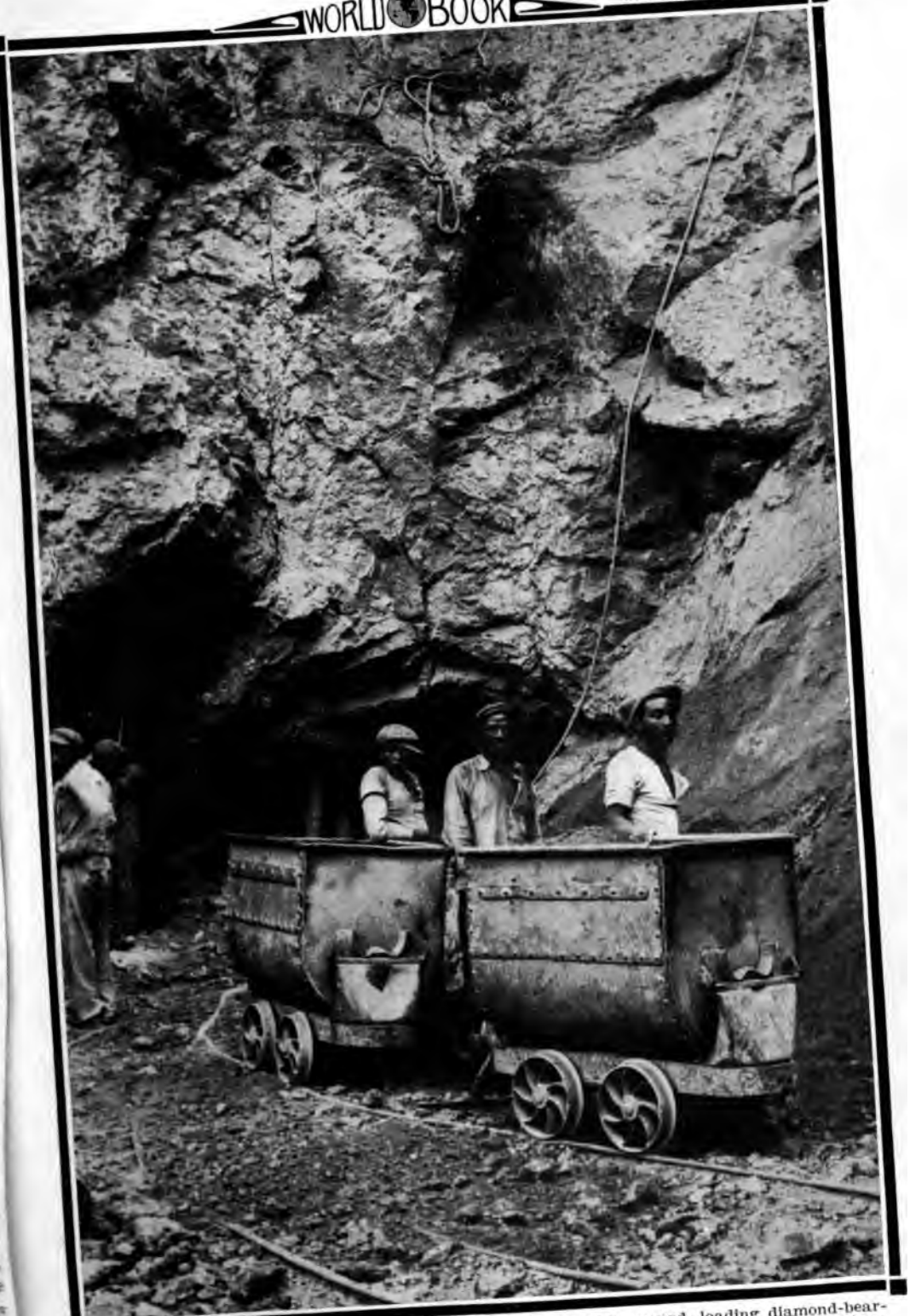

A KIMBERLEY MINE. Dangerous work far underground, loading diamond-bearing rock. Cars are hauled to the surface by elevators.

WORLD BOOK

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DIAMOND-BEARING ROCK. Exposed to the air to disintegrate before working. Photographed at Kimberley.

WORLD BOOK

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DIAMOND SORTERS. These men in South Africa are among the world's experts in valuing diamonds. Above, $30,000 in stones (mine prices).

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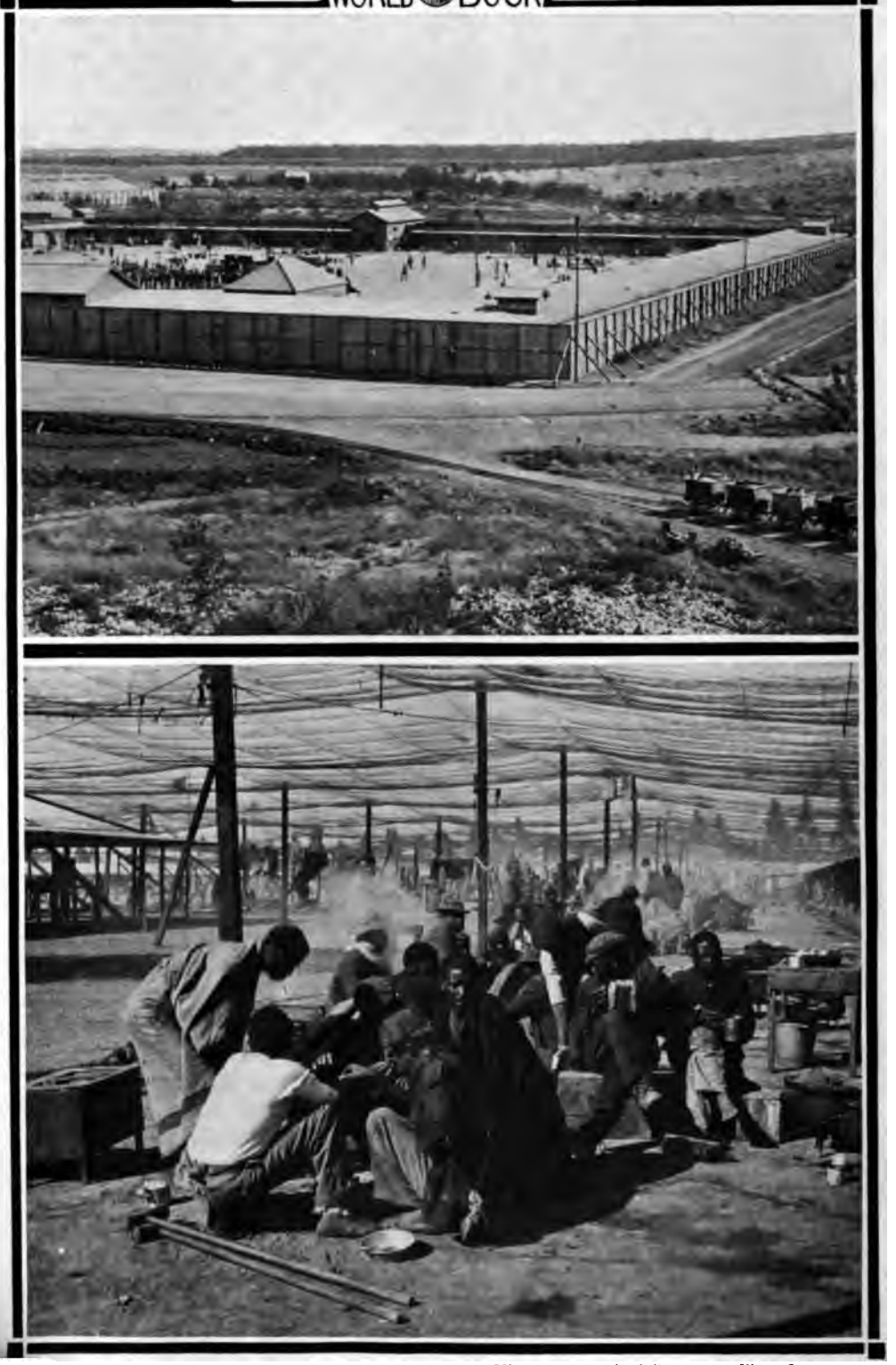


DIAMOND "COMPOUND."

View of a typical "compound" and a scene photographed when workmen are off duty.

very small diamonds are formed at the center of the lump; this would seem to indicate the process of diamond formation—carbon subjected to great heat and the tremendous pressure of cooling. It has long been known that a beautiful diamond, if heated very hot in a vacuum, or place without air, expands or swells and becomes ordinary black charcoal. If subjected to intense heat while in the air, it disappears as carbonic acid gas.

Characteristics. Diamonds form in crystals (see CRYSTALLOGRAPHY). Some of the crystals have four sides, shaped like those of a cube; some have eight sides, forming a double pyramid; others have twelve faces, each face being a parallelogram, and there are various other forms. The great brilliance of the cut stone, which is not disclosed in the rough, is due to the power of the diamond to refract, or break up, light, and this power is very much enhanced by the little planes, or *facets,* of the cut. The stones cannot be dissolved or hurt by acids and can be made to glow in the dark by rubbing, or after having been in the sunlight or in the presence of radium. Some stones, when subjected to a current of electricity in a vacuum, glow wonderfully. As diamonds are the hardest material known in the world, they can be cut and polished only by contact with other diamonds.

Value. We sometimes confuse the meanings of the two words, *valuable* and *costly.* Diamonds are certainly among the most costly things in the world, partly because they are very rare. There is no reason why the diamond should be a rare stone, except from the fact that those who own the fabulously-rich mines purposely limit the output. There are known to be sufficient diamonds in the mines of the world to supply all the people who would like to own such a stone, and they could be sold at retail at $10 per carat at a reasonable profit. However, the mine owners restrict the output every year to meet only the demand that continues at the high prices maintained. Diamonds are weighed in *carats;* in the rough at the mines they are priced at sums ranging from $3 to $15 a carat, and when ready for sale they cost $100 to $200 or more per carat, according to quality. That is only an average estimate. Some of the larger stones have been valued at fabulous sums even before cutting. Some cuts are more costly than others, for cutting is very difficult, and the kind of cut depends somewhat upon the quality of the stone. The cuts most used are the *brilliant* and the *rose.*

Diamond Cutting. In olden times, diamonds were cut in a very crude fashion. In the Dutch city of Bruges in 1746 was established a trade guild of lapidaries, or stone cutters, under the master cutter, L. von Berquem. Other guilds were soon established in Antwerp and Amsterdam, and these cities, particularly the latter, have to this day retained preëminence in the art of diamond cutting. The tools used are exceedingly simple, and practically everything depends upon the skill and knowledge of the artisan.

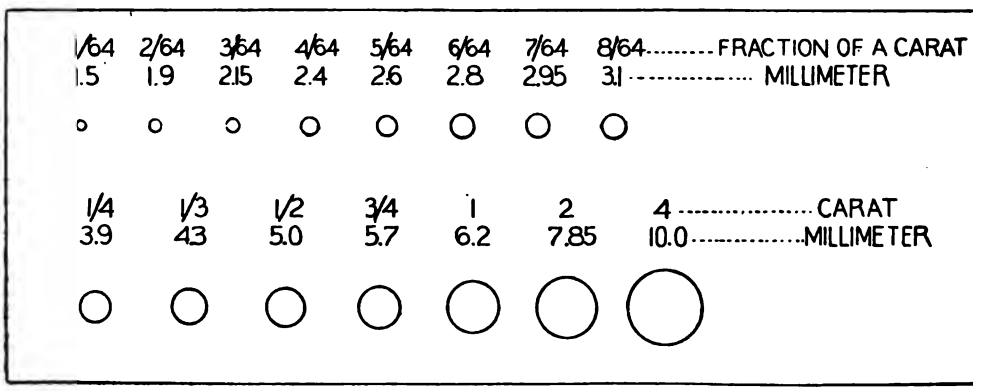
Uses of the Diamond. Because of its hardness, it is superior to any other material for cutting and drilling. Glass fitters use diamond points with which to cut their glass. Diamond dust, saved from the process of cutting, is used for fine polishing. The points of engraving tools for hard surfaces, such as glass and steel, are diamond points. Very small diamonds are used as bearings in watches, and on the points of gold pens; and larger ones are lenses in microscopes. On the end of stone drills, diamond points are invaluable because they stand great weight and great pressure. Carbonado, a form of diamond not suitable for gems, is more valuable on drills than the diamond itself, for it is slightly harder, is not so perfectly crystallized, therefore has less cleavage and is less likely to break. Diamonds in which are drilled tapering holes are used for wire drawing. A permanent, indestructible diamond needle is used in some varieties of talking machines. Besides these most common uses, there are a few other technical mechanical uses of diamonds.

Diamond Fields. The most ancient gems are known to have come from India, where the industry of gathering these stones was first carried on. The natives of low caste were the workers in this field, and the methods employed were the most primitive. The stones were found in the gravel and the sands of streams and removed as are gold nuggets in placer mining, the fine gravel being washed away in sluices and the nuggets picked out from among the larger stones. Golconda was the market for many of the Indian stones which have become known by that name. At the present time no diamonds are exported from India, and many of the old mines are no longer worked. In Brazil in 1727 valuable diamond fields were discovered whose stones excelled in quality those of India.

The story goes that in the year 1867 a traveler in South Africa paid a few pennies for a

pretty pebble picked up from the bed of the Vaal stream by the children of a Boer farmer. This stone was afterwards sold in Paris for $2,500, and eventually led to the discovery of the rich diamond fields of South Africa. These mines at present yield ninety-eight per cent of the total yearly product of diamonds, and the total value of the stones obtained since the opening of the mines amounted to more than $700,000,000 in 1916. The stones are both washed from river gravel and mined out of the earth. The miners and their families live, voluntary prisoners, within great enclosures called "compounds," to reduce to a minimum the theft of valuable stones.

Diamonds have been found in the United States (particularly in Arkansas), British Guiana, Russia, China, Sumatra and Australia, but in comparatively small quantities.



ACTUAL SIZE DIAMOND CHART FOR JUDGING STONES

Famous Diamonds. Very large diamonds of rare quality are almost without exception the property of states and royal personages. The largest Golconda diamond, called the *Great Mogul,* was once in the possession of Shah Jehan, builder of the famous Taj Mahal (which see). The *Orloff,* a magnificent Russian crown jewel, bought by Prince Orloff for the Empress Catharine II, is said to have been stolen from the eye of an idol in a Brahman temple. From the first thief it was acquired by a second, and by him sold to the Prince. The *Kohinoor,* now in possession of the royal family of England, was for many centuries handed down from one Indian prince to another. It was taken when the British invaded the Punjab and presented by the East Indian Company to Queen Victoria in 1850. The *Regent,* or *Pitt,* diamond, is an Indian gem, one of the most beautiful of the large stones, and is owned by France and exhibited in the Louvre. The most famous of the Brazilian stones is the *Star of the Sout* Many valuations have been placed upon the wonderful gems, but there is no means valuing them correctly; not one is listed less than half a million dollars, though offer of many times such a sum would probab be given the slightest consideration.

The largest stone ever discovered of whi there is any record, three times the size the largest then known, was found January 2 1905, in the Premier mine of South Africa. was called the *Cullinan* diamond, from t name of its finder, and was purchased by t Transvaal government and presented to Ki Edward VII of England. It was sent to Ar sterdam to be cut, and was divided into ni large stones, two of them among the large brilliants in existence, and into a number small stones.

How to Judge Diamonds. Weight, puri and color are three essential points to consi in buying a diamond. The accompanying d gram shows the weight in carats of diamon from 1.5 to 10 millimeters in diameter. In gard to purity, these gems are subject to th kinds of flaws: the presence of foreign miner gas- or moisture-pores, and small fissures call *feathers.* Specks of coal and graphite are t most common flaws of the first class. Th are known as *sand* when they can be seen the naked eye, and *dust* when they are mic scopic. Sometimes they appear in streaks silky layers, and sometimes they form clou that diminish the transparency of the sto and impair its color. Gas- or moisture-po often give the interior of the stone a porc appearance, and they also give rise to cloudi

In purchasing a diamond the buyer shou always use a ten- or twenty-power microsco to make sure that he is getting a stone

represented. Jewelers usually classify diamonds as first, second or third *water*. In the first class are those which are colorless and transparent and without flaws of any kind; in the second class, those which are colorless with small but unimportant defects, or faultless but with some traces of color; in the third, those which are distinctly colored, or colorless with serious faults. Stones of the first water may be perfectly colorless or they may have a tinge of blue, and they are carried only by first-class jewelers. Second-class diamonds often show traces of yellow color, which may readily be seen when the stone is examined in the sunlight. E.S.

For a further study of the subject the reader is referred to the following works: Kunz's *Gems and Precious Stones;* Streeter's *The Great Diamonds of the World;* Williams' *Diamond Mines of South Africa;* Claremont's *The Mineral Industry* (Volume VII).

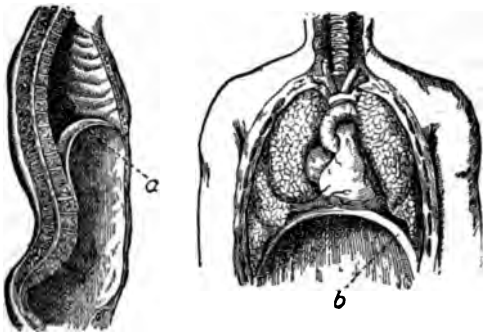
DIANA, *di an'a,* or **ARTEMIS,** *ahr'te mis,* in classic mythology the daughter of Jupiter and Leto (or Latona), and the twin sister of Apollo. She is best known as the goddess of hunting, and is most frequently represented with bow and arrows, a quiver on her shoulder, a crescent on her head and attended by hounds. She was brave in warfare and merciless in anger. Diana was identified with the Isis of the Egyptians.

DIANA

Familiarly known as the "Diana of Versailles," because for many years it was in the Palace at Versailles. It is now in the Louvre, Paris. The statue is believed to have been the work of the sculptor Leochares, who lived in the fourth century B. C.

Temple of Diana, a magnificent edifice, probably completed about 400 B. C., in Ephesus, Asia Minor, and dedicated to the worship of Diana as the goddess of fruitful nature. It was built of Parian marble, was of imposing dimensions and was considered one of the wonders of the world. It occupied the site of many previous temples which had been destroyed, one of them by the Ephesian Herostratus in 356 B. C. In A. D. 262 it was sacked and burned by the Goths, but later was partially restored. Excavations made in 1867, and subsequently, disclosed the lost site of the temple and many interesting and important details regarding it.

DIAPHRAGM, *di'a fram,* the large, muscular partition which separates the cavity of the chest from that of the abdomen. The diaphragm bends upward; its upper surface is convex and its lower, concave. It is the chief muscle in respiration (see BREATH), and when it moves downward, it presses upon the stomach and causes a pressure to bear upon all the digestive organs of the abdomen. In this way it exerts some influence over the movement of the contents of the intestines. Sudden contraction of the diaphragm results in hiccoughs.



TWO VIEWS OF THE DIAPHRAGM

(*a*) Vertical section of trunk, showing cavities of thorax and abdomen separated by the diaphragm; (*b*) the diaphragm is shown, front view.

Mammals, or milk-giving animals, are the only organisms having complete diaphragms.

The name is derived from a Greek word meaning *to fence* or *enclose.* See ABDOMEN.

DIAS, *de'ahsh,* BARTHOLOMEU (? -1500), a Portuguese navigator celebrated for his discovery of the Cape of Good Hope. In 1487, after several voyages to that part of Western Africa now known as the Gold Coast, he was placed in charge of an expedition to explore the African coast farther south. Being carried by the winds out of his course, he rounded the Cape of Good Hope without sighting it and anchored in Mossel Bay, in Cape Colony. He was compelled to turn back by the complaints of his men, and on the return voyage he located Cape Agulhas, the southernmost point of Africa. A little later he discovered Table Mountain and the cape, which he named the Cape of Storms; the king of Portugal changed the name to Cape of Good Hope. Dias perished in a storm which wrecked his vessel while he was returning from a voyage to Brazil.

DI'ATOM, a little, brown, one-celled plant which grows in either salt or fresh water, and which has often been mistaken for an animal because of its peculiar movement in the water. There are several thousand species, growing in jellylike masses in large numbers among the green algae (which see). These serve as the food for small animal forms, which in turn are food for fish. The shells of the diatoms are composed of silica, which will not dissolve in water, and consequently large masses are deposited at the bottom of seas, lakes and ponds. At Richmond, Va., is a deposit many feet in thickness. Such deposits are used as polishing powder and as the absorbent of nitroglycerine in the manufacture of dynamite.

DIAZ, *de'ahz,* PORFIRIO (1830-1915), a Mexican soldier and statesman, who after a lifetime in the service of his country, including more than thirty years as President of the republic, died an exile in a foreign land.

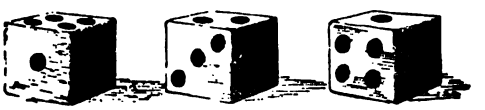
PORFIRIO DIAZ
Thirty years of peace and progress in Mexico ended with his exile to Spain in 1912.

For a time he studied law, but at the outbreak of war with the United States in 1846 he entered the army and began a military career which won him a reputation for skill and courage. He took a prominent part in the factional fights which disturbed Mexico for a number of years after the war, proving a most efficient leader of the patriots during Napoleon III's attempt to found an empire under French control. It was under his command that Pueblo and the City of Mexico were taken in 1867.

After starting several revolts in an effort to secure the Presidency he was elected to that office in 1877, through sheer force of arms. He soon proved his exceptional ability, and when, during the Presidency of General Gonzalez, it was proved that Diaz was the better man for the office, the constitution was changed so that he might continue in office as long as the people desired it. He won the confidence of his own people, and of those of foreign countries. Under his guidance trade and industries were extended, the tariff law was revised, finances were improved and important lines of railway were established.

Although there was occasional opposition to Diaz, it was not powerful enough for many years to accomplish his overthrow, for it must be admitted he ruled by the power of his army. In 1912, however, a revolution headed by General Madero resulted in the resignation of Diaz. He fled to Continental Europe, and from that point of safety followed with anguish the record his unhappy country made in the years of civil strife which started with the murder of Madero. He died in Paris. See MEXICO, subtitle *History.*

DICE, cubes of ivory, bone, wood or other material used in gambling games continuously since their invention about 1244 B.C. Dots from one to six in number are placed on all six faces of the cube, so arranged that the



DICE

total of any two opposite faces is always seven. The dice are placed in a cylindrical box, shaken, and then thrown upon a flat surface. The numbers showing on the top face form the basis for deciding the game. The highest total of the numbers showing may win, or the dice may be used in the same manner that cards count in a poker hand. Dice games are regarded as such pernicious forms of gambling that they are forbidden by law in many states and in many parts of Canada. The particular objection to dice is that play is entirely governed by chance, allowing no considerations of skill. "Loaded dice" are frequently employed by dishonest players, the sides opposite the highest numbers being so weighted with lead that "high" naturally falls uppermost when the dice fall from the box.

DICKCISSEL, a popular name for the black-throated bunting, in imitation of its loud, persistent call. It is a handsome bird, rather larger than a sparrow; the back and body are dark above and yellow below. There is a bright chestnut patch on each wing; the throat is white, and across the breast is a black crescent band. Earnestly calling from roadside fence, from weed-stalk or in the grass, it is a bird whose song is common in the open regions of Central United States and is occasionally heard in Southern Ontario. It feeds on eggs of insects, seeds and gravel and also relishes the destructive cankerworm. It is therefore a friend of the farmer.

DICKENS, CHARLES (1812-1870), one of the greatest of English novelists and an educational reformer. His works enjoyed in his own day a popularity unmatched in literary history, and they have continued to give constant exquisite pleasure to millions of readers. He was a creator who brought into life almost countless characters as real as the people who walk the streets, and more real to the minds of his readers than the characters described by historians. He made his characters represent activities in the development of great and much-needed social, educational and industrial reforms. Then, too, he possessed a genuine love for men, a grasp of the humorous and absurd and a knowledge of life among the lower classes which are certain to make him live long after more finished writers have lost their hold on the public.

Early Years. This man whom royalty delighted to honor in his later years had an unhappy and almost sordid youth. At his birth, on February 7, 1812, at Landport, Portsmouth, his family was in fairly-easy circumstances; they remained so for a time after their removal to Chatham, and finally, in 1821, to London. But the "prodigal father," as Dickens called his parent years later, was a careless, happy-go-lucky man, who at length became so deeply in debt that he was sent to a debtor's prison, the Marshalsea, afterward made famous by Dickens in *Little Dorrit*. Since a man in a debtor's prison might make himself very comfortable if he had a little ready money, it is probable that Charles' father had a better time than did Charles, who had been put to work in a blacking warehouse. All day he worked very hard and had but the scantiest food, but he could have borne all that had it not seemed to him that he had come to the end of his dreams of an education and a useful, busy life. For little Charles was very ambitious, and he had determined that somehow he was to become a great man. It was far from his thoughts that the very experiences he was going through, the very people he was meeting in his unattractive surroundings and storing up in his marvelous memory, would some day be the means of making him great.

After about a year this wretched life came to an end, and Dickens was able to go to school for two years, after which he entered a lawyer's office. In this position he was little more than an office boy, but he had time to study, and came into contact with people who saw that he was not an ordinary boy. In his spare hours he studied shorthand, and at the age of nineteen became a newspaper reporter in the House of Commons. A little later he began to contribute to the *Monthly Magazine* and the *Evening Chronicle* those sketches of London life known as the *Sketches by Boz*. So popular were these that publishers bargained for a new series, and in 1836 *Pickwick Papers* began to appear in monthly numbers. It is difficult to realize the excitement which this loosely-woven sketch, with its world-famous Sam Weller, aroused; and the great popularity they won for their author never declined through all the rest of Dickens' life. It was in 1836, too, that he was married to Miss Catherine Hogarth.

His Busy Years. With *Oliver Twist*, his next work, he introduced a new feature—that satire of institutions which actually accomplished results in more than one field. In *Oliver Twist* it was the abuses of the workhouse system that were exposed; in *Nicholas Nickleby*, the management of the cheap boarding schools; and that Dickens was not hitting beside the mark may be seen from the fact that more than one schoolmaster threatened to sue him for libel, believing himself the man caricatured in the coarse and brutal Squeers. Years later *Bleak House* protested against the interminable suits in chancery, and *Little Dorrit* against the evils of the debtor's prison system.

Meanwhile, in the weekly "Master Humphrey's Clock," had appeared *The Old Curiosity Shop*, with its paragon of children, Little Nell,

and its inimitable Dick Swiveller; and *Barnaby Rudge,* his only historical novel with the exception of *A Tale of Two Cities.* This latter gives a vivid picture of the period of the French Revolution, and the "knitting women" are not soon forgotten. Sidney Carton, the hero, is perhaps the most heroic of all

CHARLES DICKENS

Of his boyhood one authority (Long) says that he was "a poor, obscure and suffering child, helping to support a shiftless family by pasting labels on blacking bottles, sleeping under a counter like a homeless cat, and once a week timidly approaching the big prison where his father was confined for debt."

Dickens' characters, and the story as a whole is his most dramatic and artistic work. Dramatized as *The Only Way,* the *Tale* has been very popular. Other outstanding novels are *Martin Chuzzlewit,* which contains in overflowing measure Dickens' characteristic humor, but which for a time stirred up considerable feeling against him in America because of its satire on life in "Eden"; *Dombey and Son,* beloved by many because of its pathetic little Paul Dombey, and admired by progressive thinkers because of its revelation of the evils of cramming in schools; *Hard Times,* a bitter attack on the heartlessness of capital toward labor, and a most complete criticism of adulthood for robbing children of a real childhood and for preventing the development of the imagination of each child; *Great Expectations,* Dickens' well-rounded work; *Our Mutual Friend* and *David Copperfield.*

The last-named story was Dickens' favorite among his own works, and contained more that is autobiographical than all the rest together. Mr. Micawber is a sketch, exaggerated, but good-naturedly so, of Dickens' father, and the agonies of little David during his warehouse experiences are those of Dickens' self, remembered so keenly that they were a pain to him all his life. One novel, *The Mystery of Edwin Drood,* he left unfinished at his death, and it is a curious fact that while in most of Dickens' stories he cannot keep a secret but reveals the windings of his plot at every turn, in this unfinished one he kept his secret so well that no one has ever been able to complete the tale satisfactorily.

During the latter years of his life Dickens added to his immense popularity by giving readings from his own works, and his *Letters* describe most amusingly the crowds that flocked to hear him. All this was too much for his strength, however, and he died at the age of fifty-eight, at his home, Gadshill, near Rochester. Mourning for him was widespread, and the public which had loved him as though he had been a personal friend felt that he should be buried in *Westminster Abbey,* rather than at Rochester, as he had desired. Accordingly, he lies in the Poets' Corner there.

American Visits. The United States and Canada knew Dickens not only through his works but through several visits to America. The first was in 1842, and was turned by the enthusiastic people into a sort of triumphal progress. Everywhere great crowds awaited him, until he confessed himself hungry for solitude; everywhere he was feasted and flattered, and though his frankness on the subject of international copyright and his unfavorable comments on the country and its self-conscious republicanism, as written in *American Notes* and *Martin Chuzzlewit,* later brought about much criticism of him, the American people enjoyed his works too much to hold a grudge. When he made his next visit, in 1867, every hall in which he gave his readings was packed to its capacity.

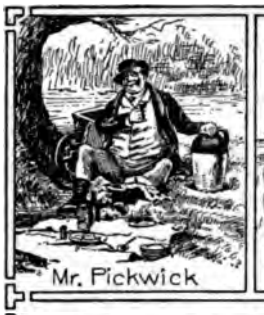
Influence on Education. Dickens never taught school, nor did he outline a system of education; he never wrote a learned book on "child-training" or "defects in modern education," yet educators of note declare him to have been the greatest educational reformer England has ever produced. Not only did specific abuses yield to his attacks, but the general spirit of education in England and the very attitude toward the child changed

slowly until they came more into accord with his ideas; and his ideas were largely those of the highest authorities to-day. Argumentative treatises were not in his line—he knew a better way to attack abuses. The evils of corporal punishment made a strong impression on him, for he had gone to school enough in his own young days to know what they were; so he wrote *Nicholas Nickleby* and drew in it a picture of monster Squeers, almost too vicious to be real, but too convincing not to be; he wrote

GADSHILL

David Copperfield, and let his readers feel the bite of Mr. Creakle's cane as he cut at the "chubby boys" whom he couldn't resist. These things and many, many more he described, with the result that thinking men all over the country began to wonder whether such abuses really existed, and if they did, to resolve that they must be corrected. To-day "Not one blow in a thousand is given to a child as compared with the time of Dickens' childhood," and of this improved state of things Dickens was not only the prophet but in a large measure the promoter.

He saw other evils, too. That of "cramming" struck him as particularly serious, and he wrote with satire as biting as it was interesting of the "mental green peas," "intellectual asparagus" and "mathematical gooseberries" that were "common at untimely seasons under Doctor Blimber's cultivation." The unwholesome restraint of children, the systematic ignoring of their individuality, the unsympathetic attitude that was adopted toward them—all these and more he attacked and at least partially vanquished. Of course not every school had all these evils, but many of the private institutions made them a regular part of their system, and parents as well as schoolmasters were likely to fall into the error of looking upon childhood as a troublesome time which



DICKENS PROGRAMS

1.

"No one thinks first of Dickens as a writer. He is at once, through his books, a friend."

Song, *The Ivy Green*.....*Dickens*
Essay, *The Childhood of Dickens*
Mrs. Jarley's Wax Works, from *The Old Curiosity Shop*
One child may represent Little Nell, and act as showman; others may be the various "wax works."
Character sketch, *Little Nell*
Essay, *How Dickens' Novels Differ from Those of George Eliot*
Reading, *A Child's Dream of a Star*.. .....*Dickens*
Essay, *What Dickens Thought of America*
Sources: *American Notes* and *Martin Chuzzlewit*
Dramatization, *Sam Weller Writes a Valentine*
Characters: Sam Weller and his father

2.

The chief work of Dickens was to lay bare the injustice, the meanness, and the blighting coercion practiced on helpless children. . . . . His was a noble work, and it was well done. *Hughes.*

Dickens in Camp.....*Bret Harte*
Essay, *How Dickens Advanced Education*
Dramatization, *David and Little Em'ly* Scenes from *David Copperfield*
Essay, *How Dickens' Novels Differ from Those of Thackeray*
Reading from *Dombey and Son,* conversation about the waves, between Paul and Florence.
Song, *What Are the Wild Waves Saying*.....*Carpenter*
Character sketch, *Paul Dombey*
Dramatization, *David Meets His Aunt*
Characters: David, Betsy Trotwood, Mr. Dick
Reading, *The Pickwick Club on the Ice*

must be undergone but which should be sternly repressed so far as possible. Gradually, through his many books with their wide sale, Dickens made more and more general his own attitude toward children, which was one not of toleration but of sympathy and alert interest. Some of his ideas are commonplace to-day, but in his time they were in advance of the age, and the benefit which they conferred on children it is impossible to estimate.

Summary. One cannot read the novels of Dickens and make the acquaintance of their wonderful characters—of Sam Weller and his father, of Mrs. Gamp, Mr. Mantalini, Mr. Toots, the Marchioness and Dick Swiveller—without realising what a delightful companion their creator must have been. To have taken a walk with him about London must have been an enlightening experience, for he possessed the ability instantly to see absurdities, incongruities, queer sidelights on human characters which another might miss, yet could not fail to appreciate once they were pointed out. And it seems most natural to find that Dickens was deeply loved by his friends, to whom he in his turn was devoted. He took an intense interest in everything connected with the theater, and delighted to take part in private theatricals, either for his children's amusement, for charity, or for the pure pleasure of doing a thing which he did very well. His dramatic ability was so pronounced that an old attendant at one of the theaters once said to him, "Oh, Mr. Dickens, if it hadn't been for them books, what an actor you would have made!"

For a time, about twenty years after his death, Dickens was somewhat underrated, and there are not lacking to-day those who think that his books will some day be so "out of date" that they will lose their popularity; but the weight of opinion is all on the other side. Most authorities hold that Dickens' fame will increase rather than diminish, and there are some who do not hesitate to declare that in generations to come he will stand out as the greatest creative genius that England has produced. Count Tolstoi strongly held to this view. He kept but one picture on the wall in his room, and that was a portrait of Dickens. It is a fact that in 1915 his books were selling more widely than ever before. J.L.H.

Those who are sufficiently interested in Dickens to wish to study his life will find Forster's *Life of Dickens* most satisfactory, while Dickens' own *Letters* afford much information and are as delightful as one of his novels. G. K. Chesterton has written a most appreciative *Critical Study*, and James L. Hughes has published *Dickens as an Educator*. For assistance in writing a bi raphy of Dickens, see BIOGRAPHY, page 724.

DICKSON CITY, PA., a borough of Lac wanna County, in the northeastern part of state, four miles north of Scranton and miles north and west of Philadelphia. It is the Delaware & Hudson and the New Yo Ontario & Western railroads. Electric int urban lines extend to Scranton and ot towns. Dickson City is in the largest anth cite coal region in the United States. Th are several mine openings within the limits the borough and coal mining and shipping the principal industry. There are also fo dries, machine shops and silk mills. The p ulation, which was 9,331 in 1910, had increa to 12,086 in 1916. The area of the borough three square miles.

DICOTYLEDON, *di kot e le'dun.* See s head, under COTYLEDON.

DICTATOR, *dik'ta tur,* a magistrate of Roman Republic who was elected only in c of great national emergency, and to wh supreme power was given. He could hold of for six months, but was eligible to reëlect if the emergency yet existed. When it found necessary to place a man at the head affairs the Senate appointed one consul to m the selection. The dictator had power of and death, without appeal to people or to Senate, but could not leave Italy and no control over the treasury. Julius Cae was on three occasions appointed dictator, last appointment being for life. Cincinna left his plough to become dictator, return to his farm when he had saved the repub In 82 B.C. Sulla was elected to the office contrived to get himself reëlected again again, holding the office for three years. A the death of Julius Caesar the office was ab ished. See CINCINNATUS.

DICTIONARY, *dik'shun a ri,* from a La term meaning *word,* means literally a *book.* As commonly used, it means a bo which contains in alphabetical order all or p of the words of a language, with definitio pronunciation and examples showing their and with frequent illustrations. To a gro person it seems a very simple matter to fin word in a dictionary, but it is not a facu which comes naturally to children; often use of a dictionary is one of the difficult thi which a teacher must teach. Boys and g have ability to use correctly only a few hund words, while their fathers and mothers may

have a vocabulary exceeding 2,000 words. Therefore a dictionary, which may define from 100,000 to 400,000 words, is a necessity in every household.

Children should be able, before they leave the fifth grade, to look up a word quickly, to discover its pronunciation and to pick out its various meanings; this they can best accomplish in some of the smaller, more simple dictionaries. But the older children should be taught to use a complete, or unabridged, dictionary and to appreciate the wealth of information to be found there. The difference in the amount of knowledge which two people can glean from a given paragraph in a dictionary may be very enlightening. One will find only the meaning of the word sought, and perhaps not the very best meaning for his purpose; another will discover fact upon fact—word forms, obscure or old meanings, apt quotations and a tracing of derivations which is a veritable word-romance. There is given herewith an illustration, explaining all that is said in a certain standard dictionary about a common word; and by means of guide letters the varied character of the information is pointed out. Some words call for less explanation and illustration and some for far more; this is a fair average.

The large school or library dictionaries also contain much other matter besides word definitions. Lists of geographical and biographical terms, with brief explanations; much-used terms from foreign languages; national flags, state seals—all this and more is to be found in the various appendices. The pictures should not be neglected; they are inserted not for ornament but to make the text clearer, and in many instances have been drawn by high authorities in the subjects which they portray.

History of Dictionaries. The dictionary is far from being a modern invention, for the Assyrians had one of their language over 2,500 years ago, pressed in cuneiform characters on clay tablets (see CUNEIFORM INSCRIPTIONS). The Arabians, the Greeks and the Romans, too, compiled dictionaries; they did not make any attempt at giving all the words of a language, but contented themselves with listing rare or difficult words. During the Middle Ages, when an ever-growing interest in Greek and Latin literature was felt, there arose the need for *lexicons*—dictionaries which define the words of one language in terms of another—and with the increased intercourse between peoples this need has become even stronger. To-day there

GETTING INFORMATION FROM A DICTIONARY

A. The dictionary gives the pronunciation of a word. Almost always a list of well-known words is given at the bottom of the page to make clear the method of marking pronunciation.

B. It tells the part of speech of the word.

C. In the case of a verb, the dictionary tells whether it is transitive or intransitive—that is, whether it may or may not take an object.

D. It gives the principal parts.

E. It indicates the language and the word or words from which the word under discussion is derived. For added clearness, it shows the make-up of the source word.

F. It refers to other words which are related in meaning.

G. If certain meanings of the word have passed or are passing out of use, the dictionary makes clear that fact by the use of the abbreviation *Obs.* (Obsolete) or the word *Archaic.*

H. In some cases it gives quotations from well-known sources to show in what period the word was in use in its now obsolete sense.

I. It lists the various meanings of a word under different numbers.

J. It illustrates the correct method of using a word by showing how some writer of good English has employed it.

K. It gives a list of synonyms—that is, of words which mean the same or nearly the same.

L. By means of further definitions and carefully chosen illustrations, it points out just the shades of difference between these similar words.

M. It refers to other words under which related information is given.

are lexicons which make almost every language on the globe, and many dialects, available to English students.

Of English dictionaries which aimed at completeness the first was that of Nathan Bailey, published in 1721 and called the *Universal Etymological English Dictionary.* The English dictionary of Samuel Johnson, published in 1755, marked an epoch in the history of the English language and created a stir which it is difficult for the present age, rich in dictionaries, to understand. A dictionary is the last place in which one would expect to find humor, yet Johnson introduced it, consciously or unconsciously, into his. Oats, for instance, he declared to be "a grain which in Scotland forms the main subsistence of the people, but which in England is fed to horses." It was Johnson who introduced the practice, now well-

nigh universal, of illustrating the use of words by quotations from various authors.

Other dictionaries of the English language are that of Noah Webster, published in America in 1828, revised frequently and extensively, and still, as *The New International Dictionary*, a standard work containing over 400,000 defined words; Worcester's *Dictionary of the English Language; The Standard Dictionary;* and *The Century Dictionary;* the last-named is a combination, to a certain extent, of dictionary and encyclopedia features. Perhaps the greatest of all dictionaries is the *New English Dictionary*, begun in 1884 and completed in 1915. This is known popularly as the *Oxford Dictionary*, and is published at Oxford University. Its quotations are unusually full and illuminating and are arranged chronologically, while its study of word-history traces every word through all its changes and modifications. See LANGUAGE; ENGLISH LANGUAGE. A.MC C.

DICTOGRAPH, *dik'to graf*, an instrument made on the same principle as the telephone, but with an attachment that greatly increases the volume of sound at the receiving end. Since 1912, when it was perfected, it has been extensively used as a means of detecting or preventing crime. It is so small as to be inconspicuous and can be installed in a room without anyone's being aware of its presence. The fine connecting wires may be carried to any desired place and a person stationed at the receiver can hear conversation, even loud whispers, carried on in the room containing the transmitter.

DICTOPHONE, *dik'to fone*. See PHONOGRAPH.

DIDACTIC, *di dak'tik*, **POETRY**, that kind of verse produced by a poet when his chief object is to instruct or impart information.

The *Georgics* of Vergil and Horace's *Art of Poetry* are classic examples of didactic poetry, the former being an account of agriculture and kindred arts, and the latter a discussion of the principles of poetry. Pope's *Essay on Criticism* and his *Essay on Man* are among the best-known didactic poems in English literature. The familiar couplet which follows is an admirable illustration of this type of verse:

> Know then thyself, presume not God to scan;
> The proper study of mankind is man.

Longfellow's *A Psalm of Life* may be considered an example of a short didactic poem.

The exact nature and purpose of poetry is a matter of dispute. Some critics, those of the Edgar Allan Poe class, tell us that the function of poetry is to give pleasure, and that Pop *Essay on Man* cannot properly be cal poetry. A medium ground is taken by th who claim that the highest forms of poe teach important lessons of life without be purposely didactic. Milton's *Paradise L* Goethe's *Faust* and Shakespeare's dramas contain valuable ethical teachings, but th spring from the very heart of the masterpie which are in no sense examples of dida verse.

DI'DO, or ELIS'SA, founder and queen Carthage, was the daughter of a king of Ty called variously Belus, Agenor and Mutgo. was the wife of Acerbas. Her brother P malion, coveting her husband's possessi

AENEAS AT THE COURT OF DIDO
From the painting by Guerin.

murdered him. Dido, concealing her wea and accompanied by many devoted people Tyre, fled to Africa. She landed near Utic colony of Tyre, where she was promised much land as might lie within the bounda of a bull's hide. Cutting a hide into many t strips, she pieced them together, and t secured an extensive territory. Here she b Carthage. Iarbas, a neighboring prince, wis to marry her, threatening war if she refu Hating and fearing him, she erected a fun pile, threw herself upon it and stabbed her in the presence of her subjects. Vergil gi a different version of this episode, attribut Dido's suicide to her love for and abandonm by Aeneas, a Trojan hero (see AENEAS). D was worshipped in Carthage as a goddess.

DIE, a tool used for stamping metals leather. The design to be stamped is engra on the die, which is usually made of hi quality steel. Coins are stamped on both si at once by using two dies. Some dies made for use by hand, but machinery is g erally employed for stamping metals.

Die Sinking. The making of dies, called die sinking, is an industry requiring great skill. The die sinker first makes a pencil tracing of the design he is to reproduce. The surface of the metal employed is coated with white paste, on which the tracing of the design is pressed. Gentle rubbing of the back of the tracing causes the lines to be transferred to the surface of the metal. The lines are then cut to the required depth with sharp steel tools. From the original die, which is hardened and tempered, any number of copies may be made by stamping or punching in a softer metal, which is then hardened for use.

DIELECTRIC, *di e lek' trik,* the name generally given a non-conductor of electricity, such as the glass between the outside and inside coating of a Leyden jar (which see). In other words, a dielectric is an *insulator;* the term is particularly applied to a non-conductor placed between two good conductors of electricity. In the practical use of electricity mica and paraffin paper are extensively used as non-conductors. See ELECTRICITY; INSULATOR.

DI'ET. This word is derived through the French and Latin languages from the Greek *diaita,* which means *manner of living.* In the English language, however, the meaning is confined to one item of the manner of living, namely, the food. The food which one takes regularly is one's *diet.* Very often a person suffering from disease is "put on a diet"; that is to say, the physician prescribes the nature of the foods to be taken, and sometimes the quantities of each. Soldiers and sailors are issued a certain ration, that is, allowance of foods. If a soldier uses his whole ration, that ration constitutes his diet. The diet of a healthy person must be such as to maintain the health. It must contain sufficient of the proteins to make good the waste of protein that is inseparable from the life-processes of the body. It must also contain sufficient fuel material to maintain the body temperature and to provide energy for all the motions of the body. It must include sufficient water to make up for the water eliminated from the body through the lungs, skin and kidneys; and, finally, it must contain sufficient of each of the minor constituents of foods for its peculiar functions.

Under the title FOOD in these volumes will be found a classification of the substances found in foods and a table showing the composition and fuel value of some common foods. In the same article the influences of sex, age, occupation and climate upon the food requirements are discussed. The following is an estimate of the daily food requirements of a man of average weight (150 pounds) doing an average amount of work:

Proteins, four ounces; fats, three ounces; carbohydrates (sugars and starches), fourteen ounces; water, four quarts.

Such a diet would have a fuel value of 2,850 calories (see CALORIE). These requirements would be met by the following selection of foods (but it must be borne in mind that many other combinations of foods could be made which would also conform to the same standard):

One pound bread, one-half ounce butter, three ounces oatmeal (dry weight), one and one-half pints milk, four ounces roast beef and two ounces sugar.

In armies and navies, and in prisons, hospitals for the insane and other institutions where large numbers of people have to be fed regularly, the *dietary* has to be carefully worked out so as to provide enough food for each person and enough of each food substance, and at the same time to keep the cost as low as possible. The branch of hygiene and medicine which treats of diets in their relation to health and disease is called *dietetics.* J.F.S.

Related Subjects. The reader is referred to the following articles in these volumes:

Carbohydrates	Food
Digestion	Protein
Fats	

DIET, the name applied to the Hungarian Parliament and to the legislative assemblies of German states and Austrian provinces. In the days of the Holy Roman Empire the name was given to the imperial Parliament. The word also refers to a formal public assembly, popularly applied in Europe for many years to religious assemblies for special purposes. In 1521 Martin Luther was brought before the Diet of Worms for inquiry into what were considered his heretical views.

DIFFRACTION, *dif frak' shun.* If the edges of two knife blades are placed together and held up to the light one can see rainbow tints through them. If a small round hole is made in the shutter to a dark room and the rays of light forcing through it are allowed to fall on a screen, an image of the sun surrounded by rainbow tints will be seen. A slit in a window shade will produce a similar effect. This play of colors is also seen in the mother-of-pearl

and on the plumage of some birds. It is called diffraction of light, a term which means *breaking away from*. Diffraction is caused by interference with the waves of light. See LIGHT.

A plate of glass prepared for the purpose and ruled with at least 2,000 lines to the inch exhibits a beautiful play of colors. Such a plate is known as a *diffraction screen*. It may be made by ruling on glass covered with gold leaf or a coating of India ink and glue. A study of diffraction led to the invention of the spectroscope (which see), and it has also been of great assistance in the study of the spectrum. See SPECTRUM ANALYSIS.

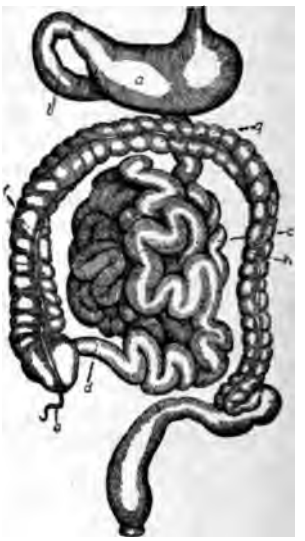
DIFFUSION, *di fu'zhun,* is the mixing of two fluids when brought in contact. Fill a glass fruit jar two-thirds full of water, then by means of a pipe inject to the bottom of the jar a little red ink. Within a short time all the water will have a red tint; this thorough mixing is *diffusion*. A dark-colored syrup can be used in place of the ink, but it will act more slowly. Gases diffuse more rapidly than liquids. Were it not for diffusion the different gases in the atmosphere would arrange themselves in layers; the carbon dioxide, or carbonic acid gas, which is the heaviest, would be at the bottom, the oxygen would be next, and the nitrogen would be at the top. See AIR.

Diffusion of gases is easily illustrated in a chemical laboratory by the following experiment: Fill one flask with chlorine gas and another with hydrogen, taking care to close the mouth of each jar so no gas can escape. Then connect the jars by means of a glass tube so that the jar containing hydrogen will be inverted over that containing chlorine. Although the hydrogen is much the lighter, some of it will descend to the lower jar, and some of the chlorine will rise to the upper jar. The change would take place even through a thin plug of plaster of Paris.

DIGESTION, *di jes'chun.* The food which is taken into the mouth, however well cooked and palatable it may be, is not in such condition that it may be absorbed at once by the blood and used to nourish the body. Various changes must take place, some in the mouth, some in the stomach, and some in the intestines. The process by which these changes are brought about is known as *digestion.*

The Mouth. Digestion begins in the mouth, where the food is ground into fine particles by mastication and mingled with *saliva,* which moistens it and changes some of the starch to *maltose.* Thus thorough mastication serves a two-fold purpose; it mixes saliva with the food and grinds the latter so the fluids of the stomach and intestines can more readily act upon it. When mastication is not thorough there results *indigestion,* or failure of digestion.

The Stomach. The masticated food passes down the œsophagus into the stomach, where further changes take place. The gastric juice is mingled with the food by a peculiar churning motion, caused by the contraction of the muscles of the stomach. The gastric juice starts the digestion of the *proteins,* or nitrogen-bearing foods, such as eggs, lean meat and milk. A ferment called *rennin* curdles the milk and aids in its digestion. The starches, sugars and fats are not changed by the gastric juice. The time required for digestion in the stomach varies from two to four hours, according to the nature of the food. The partially digested food, known as chyme, passes on into the intestines.



CHANNEL OF DIGESTION
Below the mouth, the processes of digestion are related to the following organs:
(*a*) Stomach
(*b*) Duodenum
(*c*) Small intestine
(*d*) Termination of the ileum
(*e*) Vermiform appendix (now obsolete)
(*f*) Ascending colon
(*g*) Transverse colon
(*h*) Descending colon

The Intestines. The last stage of digestion takes place in the small intestine. Here the bile and pancreatic juice are mingled with the chyme. These fluids act upon the fats, starches and proteins; the digestion of proteins is completed, and also that of starch, which is begun in the mouth. The fats are changed into a soapy substance. The intestinal juices complete the work of forming *chyle,* the fully digested food which is ready to be absorbed by the lymphatics and carried to the blood vessels. There is little or no digestion in the large intestine. W.A.E.

Related Subjects. The following articles in these volumes bear a more or less close relation to the topic of digestion:

Absorption Alimentary Canal

Bile	Nutrition
Chyle	Pancreas
Chyme	Peptones
Fat	Proteins
Fletcherizing	Saliva
Gastric Juice	Starch
Health Habits	Starvation
Intestines	Stomach
Liver	Sugar
Mastication	Taste
Mouth	Teeth

DIGIT, *dij'it,* a word derived from the Latin *digitus,* meaning a *finger.* It is now applied to any one of the ten numerals from 0 to 9. A number of three figures, such as 134, is said to consist of three digits. See ADDITION; MULTIPLICATION; DIVISION.

In astronomy a digit is one-twelfth of the diameter of the sun or moon. In measuring an eclipse, if eight of the twelve divisions of the surface are covered, it is spoken of as an eclipse of eight digits.

DIGITALIS, *dij i ta'lis,* a genus of flowering plants, the most common of which is the foxglove, a native of Great Britain but now extensively cultivated in the United States and Canada. The word is Latin, and means *pertaining to a finger.* It is applied to these flowers because they bloom in finger-shaped tubes, or bells. The leaves of the plant are used in medicine, for they are specially valuable for their influence upon heart action and the circulation of the blood. The drugs extracted from the leaves are known by various names, such as *digitalis, digitoxin, digitonin* and *digitin.* They should never be administered except by a skilled physician, as their unwarranted use may lead to severe poisoning and sometimes to death. See FOXGLOVE.

DIJON, *de zhoN',* the capital of the French department of Côte d'Or, beautifully situated in a fertile valley at the junction of the Ouche and Luzon rivers, 195 miles southeast of Paris. It has important manufactures of woolen goods, hosiery, chemicals and paper, and is particularly noted for its production of mustard. There are also tanneries, iron foundries and cotton mills. The cathedral, a magnificent Gothic building dating from the thirteenth century, has a carved wooden spire 300 feet in height. The city is strongly fortified, according to beliefs entertained before the War of the Nations changed opinions as to defenses.' Dijon was the stronghold of the dukes of Burgundy from the eleventh to the fifteenth century, but after the death of Charles the Bold in 1477 it was annexed to France. Population in 1911, 76,847.

DIKE. In the formation of the earth's crust molten rock was occasionally forced to the surface through crevices in stratified or igneous rock, the latter being rock formed by the action of heat. The molten rock cooled and became solid, forming a rock harder than that upon each side of it. Geologists have given the name *dike* to these formations, it being probably from a Greek word meaning *wall,* or *dam.* Dikes vary in thickness from a few inches to a hundred feet or more. The rock in them being harder than that on either side, the dikes in time form ridges as the surrounding rock is worn away, and large dikes often cause unevenness of surface. Dikes should be distinguished from *veins,* which sometimes contain ore.

Artificial embankments for the purpose of keeping a river in its channel or to protect lowlands from the sea are also called dikes, particularly in Europe. Holland has been reclaimed from the sea almost entirely by dikes, without which the North Sea would inundate the country (see NETHERLANDS, THE).

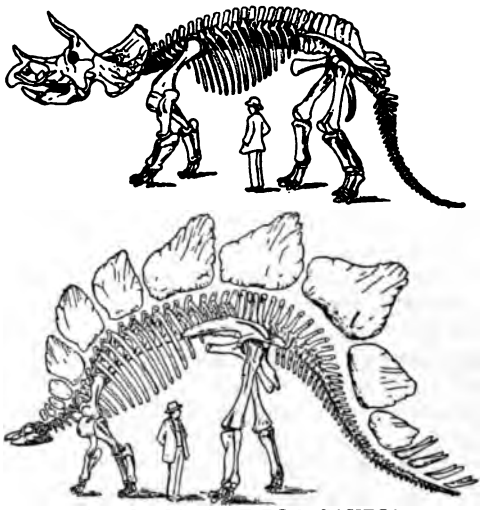
DILLON, JOHN (1851-), an Irish agitator and politician, from 1896 to 1899 the recognized leader of the Irish Nationalists. He was born and educated in Dublin, and entered Parliament as a member for Tipperary in 1880. He was twice imprisoned for inciting the Irish peasantry to violence, but stoutly held to his plans for freeing Ireland from English domination. Ill health caused him to remain out of Parliament for a few years, but he was reëlected in 1885, and has been regularly reëlected since. He visited the United States and Canada on several occasions and received encouragement from various Irish organizations.

DIMITY, *dim'i ti,* a dainty cotton fabric with a raised stripe or figure woven in the loom. It is used for summer dresses, curtains and covers in bedrooms, white being the common color. A heavier quality is often colored and used on furniture. The name comes from a Greek word meaning *made with a double thread.*

DINGO, *ding'go,* the name for the wild dog of Australia, remarkable as the only dog that exists both wild and domesticated in the same country. These wild dogs hunt in packs and are sometimes very destructive to herds of sheep, and on this account are fast being exterminated. In color the dingo ranges from tawny to almost black. It stands two feet high; its body is about two and one-half feet long, its hair is rough and coarse, and the tail

is long and bushy. In its wild state the dingo does not bark, its cry being a wolflike howl, but when associated with domestic dogs it learns to bark. If captured as a puppy and well treated, a dingo makes a faithful and affectionate companion and will valiantly defend its master's sheep against the attacks of its wild relatives.

DINOSAURIA, *di no saw' ri a,* a word derived from Greek words meaning *terrible lizard,* and now applied to a group of fossil reptiles whose remains are found in rocks of great age. They were apparently intermediate between lizards



SKELETONS OF DINOSAURIA

and birds; some ate vegetables, while others devoured other animals. The crocodiles of the present day were probably from the same original stock, though vastly inferior in size to the prehistoric reptiles. The *megalosaurus,* one of the largest species, attained a length of more than forty feet and was a flesh-eating reptile. The *diplodocus* was probably sixty feet in length, and according to expert calculations required about 500 pounds of vegetable food daily. The *iguanodon,* which was about twenty-five feet in length, also lived on a vegetable diet. The chief characteristic of most of these was the smallness of their heads in comparison with their enormous bodies. The brain development was very slight, indicating a very low order of intelligence. From fossil remains scientists have been able to reconstruct skeletons showing what these reptiles were in life.

See Fossil.

[redacted]DDIE, *din' wid i,* Robert (1690-1770), [redacted]overnor of Virginia who hastened [redacted]: of the threatening French and Indian War. This was unintentionally accomplished by sending George Washington, in 1753, to the French commander with the demand that the French withdraw from Western Pennsylvania, where they were occupying land claimed by Virginia. In the war which followed Dinwiddie urged the colonies to help the English drive the French from the Ohio Valley, and he gave valuable aid to the expedition of 1755 sent against forts Duquesne, Niagara, Frontenac and Crown Point. He was continually quarreling with the colonial assembly, however, because of its reluctance to vote funds for carrying on the war; and his unpopularity was increased by his arrogance and miserliness. In 1758 he was recalled. See French and Indian Wars.

DIOCLETIAN, *di o kle' shan,* (A.D. 245-313), one of the emperors of Rome. He was of obscure parentage, but showed bravery and ability as a soldier, and the army in 284 raised him to the highest power. He introduced many reforms and installed Maximian, a rude, uncouth soldier, as his colleague. Two assistant emperors called *Caesars* were also appointed and were promised the imperial power in succession. Diocletian and Maximian resigned in 305, their places being taken by Constantius Chlorus and Galerius. The reign of Diocletian was marred by bitter persecution of Christians, the responsibility for which, however, rested mainly with Galerius.

The farmer who loves his life work above all else will understand the serenity of Diocletian's old age. Maximian took unkindly his forced abdication with Diocletian and sought to have the latter regain for the two the power they had lost. The old man replied, "Were you but to come to Salona and see the cabbages which I raise in my garden with my own hands, you would no longer talk to me of empire."

DIOGENES, *di oj' e neez* (412-323 B.C.), a famous philosopher of Athens, commonly called "the Cynic," because of his extreme and literal interpretation of the teachings of the Cynic school. He may be regarded as one of the earliest and most pronounced advocates of the simple life. The many stories told of his surly manners, his bitter humor and his mockery of his fellow citizens, while they do not represent his true character, are nevertheless suggestive of his independent, uncompromising nature. His father, a native of Sinope, in Asia Minor, was imprisoned for coining false money, and Diogenes went to Athens, where he became

a disciple of Antisthenes, founder of the Cynic philosophy. Though he was treated with great brutality, the pupil soon surpassed his master in learning and in the rigid asceticism of his life.

According to familiar tradition, Diogenes subsisted on the coarsest bread, slept at night in a tub, and even threw away his only drinking cup because he saw a boy drink out of the hollow of his hands. When he went about the city in broad daylight, carrying a lighted lantern which he thrust into the faces of passers-by, he said, in answer to inquiries, that he was searching for an honest man. He wore a long beard, and, like Socrates, walked the streets of Athens barefooted and clothed in a single garment.

DIOGENES
From the painting by Gérôme.

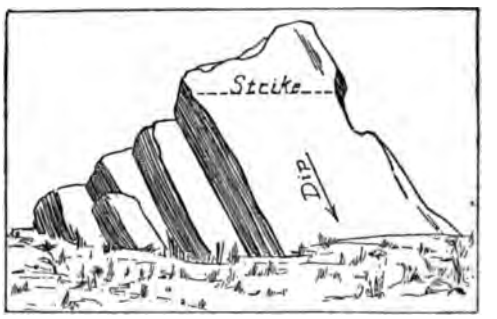
While on a voyage to Aegina, Diogenes was captured by pirates and sold as a slave. He informed his captors that he knew no trade except that of governing men and suggested that he should be sold to "a man who needs a master." As tutor to the sons of a wealthy Corinthian, he spent the rest of his life in Corinth, dying on the day on which Alexander the Great died in Babylon. In the city of Corinth the world conqueror and the philosopher had a famous interview. In the course of their conversation Alexander said, "How can I serve you, Diogenes?" "By standing out of the sunshine," was the Cynic's unexpected reply. So impressed was Alexander with the philosopher's self-possession that he remarked as he went away, "If I were not Alexander, I should wish to be Diogenes."

In spite of his eccentricities, the philosophy of Diogenes represents the best teachings of the Cynics, for he emphasized the value of self-control and the necessity of returning to simplicity and nature. His peculiar manner of living was a result of his belief that pain and hunger are helps in the pursuit of happiness, and all pleasure is preventive of goodness. See CYNIC SCHOOL OF PHILOSOPHY. B.M.W.

DIONYSIUS, *di o nish' i us,* **THE ELDER** (431?-367 B.C.), tyrant of ancient Syracuse, a man of obscure parentage who began life as a clerk in a public office. By his own ability and energy he rose until he made his power over Syracuse absolute. In his wars against Carthage he met with many successes, but was not able to drive the Carthaginians out of the island. He made many expeditions against neighboring cities and to the mainland of Greece and Italy. The towns he captured were destroyed, and the inhabitants were usually sold as slaves. Historians depict him as cruel, ambitious, vindictive and suspicious, a tyrant in a very real sense of the word. Under his rule, however, Syracuse became a brilliant center of Greek civilization, art and culture.

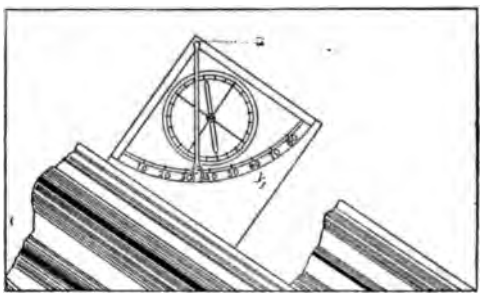
It was his son, DIONYSIUS THE YOUNGER, in character much like his father, who is said to have condemned Pythias to death. This act is supposed to have given Damon his opportunity to prove that a man's faith in his friend may be a truly wonderful thing. See DAMON AND PYTHIAS.

DIP. We often see rocks tilted up so that they almost stand on edge. We see others lying flat, and between these two positions there are rocks lying at all angles. The angle which the surface of a layer of rock forms with a vertical line is called in geology the *dip* of the rock. Dip is measured by a very simple instrument called a clinometer, consisting of a square block of wood with a plumb line fastened to one corner and having the arc of a circle graduated in degrees marked around the opposite sides. When the block is placed upon the rock the plumb line takes a vertical position and the point it touches on the arc



ILLUSTRATING DIP AND STRIKE

tells the number of degrees of dip. The horizontal direction at right angles to the dip is called the *strike*.



HOW DIP IS MEASURED

DIPHTHERIA, *dif the'ri a,* an acute infectious disease of frequent occurrence among children, characterized by a very painful sore throat. The bacillus which produces diphtheria causes the formation of a false membrane composed of lymph, which appears first in patches on the mucous membrane of the tonsils; it then extends to the larynx, up into the nasal passages and into the mouth. In severe cases it may extend down into the esophagus, forming there such a growth as practically to close the windpipe and to cause suffocation. The glands in the neck and in front of the ear also become swollen and tender. If the diphtheria membrane is rubbed off a very tender bleeding spot will remain. Weakness and depression, fever, thirst, nervousness, sleeplessness and loss of appetite are typical symptoms. Meningitis and Bright's disease are frequently complications of diphtheria, and paralysis often occurs during the attack or a few weeks later. The disease begins with sore throat and low temperature, and such a condition should always receive immediate attention. Children showing white patches on throat or tonsils should be examined at once by a competent physician.

Treatment. Success with diphtheria depends upon early treatment, and that now in general use consists in the injection of an antitoxin (which see) into the body of the patient. This is a preparation containing a substance that counteracts the poisons developed by the germs and renders them harmless. Its use has reduced the number of deaths from diphtheria more than one-half, but it must be employed in the early stages of the disease. Delay in diagnosis and treatment of diphtheria cannot be too strongly condemned. Recovery depends upon checking the infection at the beginning.

Caution. Diphtheria is one of the worst of contagious diseases, especially among children. The patient should be isolated and all discharges, clothing, bed-linen and utensils used about the sick room should be thoroughly disinfected. After the patient's recovery, the house should be fumigated and every possible precaution should be taken to prevent the spreading of the disease. Diphtheria may occur in connection with other contagious diseases such as measles and scarlet fever, and patients suffering from these maladies should be carefully watched for its symptoms. Inoculating other members of the family with the antitoxin is practically certain to prevent the spread of the disease within the household, and this precaution should be used when children at school have been exposed, since it may prevent an epidemic. W.A.E.

DIPHTHONG, *dif'thong* or *dip'thong,* the sound produced by combining two vowels into a single syllable, as *ou* in *out,* and *oi* in *void;* these are examples of *proper* diphthongs. An *improper* diphthong is the combination of two or more vowels in the same syllable, only one of which is pronounced, as *ai* in *rain,* and *ea* in *breach.*

DIPLOMACY, *di plo'ma si,* the system, science, or courteous practice by which political negotiations between two countries are conducted. It involves intercourse on each side through accredited representatives, according to customs prescribed by international law; these agents, in order of rank, are ambassador, envoy extraordinary and minister plenipotentiary, minister resident, *chargé d'affaires,* secretary of legation and attaché. The greatest nations send to each other envoys of the highest rank; smaller countries appoint those lower in dignity, and receive representatives of like rank. The consular system of a country is not a part of its diplomatic service; its scope is purely commercial. See CONSUL.

A diplomatic office is not relatively an ancient institution. It was not a part of the Greek political system, neither did the Romans resort to it except to commission occasional embassies for special purposes. As relations between countries grew more complex there developed gradually a need of political representation at all times in the various capitals. Cardinal Richelieu is regarded as the originator of the system of resident ministers, although he was probably not the first to realize its advantages. Cobden, on the contrary, contended that personal representation had been

developed only to satisfy the vanity of governments and that all diplomatic relations might easily be conducted by letters and by telegraph.

A diplomatic officer abroad concerns himself only with affairs affecting the political welfare of his own government, or the rights of the citizens of his country living or traveling abroad. He is the accredited spokesman for his government, keeps informed on everything in affairs of state it is desirable for his home officials to know, and transmits this information in formal reports, using a cipher code. The practice of diplomacy has varied little in its forms for scores of years. It is marked by great dignity, polite ceremonials and every outward showing of studied cordiality. "Study the art of diplomacy," says Lord; "even in declaring war, men are quite courteous."

Diplomatic representatives enjoy important privileges and immunities, partly owing to the fact that they are the direct representatives of sovereign powers, partly because the important functions which they perform demand complete independence of action. The more important of these immunities are as follows:

(1) Exemption of the person of the minister from local jurisdiction, civil and criminal. In other words, he is not liable to arrest for any reason whatever, an exemption shared to a certain extent by his family and suite.

(2) Inviolability of his residence, papers and effects from any search or seizure.

(3) Exemption of his personal belongings from taxation.

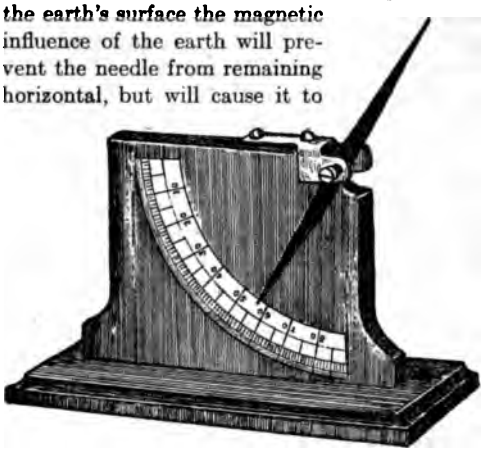
(4) Entire freedom of worship for himself and his suite. These privileges result from the principle known to law as *exterritoriality;* that is to say, by a legal fiction the minister is supposed to carry with him the jurisdiction of his home government over his person and residence, excluding to this extent the foreign jurisdiction.

The diplomatic affairs of each nation are under the direction of its *Foreign Office,* a term meaning the same as *Department of State* in the United States (see STATE, DEPARTMENT OF). W.B.G.

Consult Foster's *Practice of Diplomacy as Illustrated in the Foreign Relations of the United States;* Curtis's *United States and Foreign Powers;* Moore's *American Diplomacy.*

DIP'PER, or **WATER OUZEL,** *oo' z'l,* a little thrushlike bird which dips and dives under water. Several species are found in Asia, Northern Europe and in the mountains of Western America from Alaska to Mexico. The bird's waterproof plumage is dark colored, but the breast is white. It is short-winged, and its short, up-tilted tail makes it resemble a wren. The dipper lives along mountain streams, and dives into the water for its meals of snails and water insects, which it catches with its straight, compressed, sharp-pointed bill. The bird seems to delight in waterfalls, for it dashes into them in a fearless manner and goes entirely through a cascade to build its nest of moss in a sheltered crevice of rock.

DIPPING NEEDLE, a magnetic needle supported horizontally above a dial,. so it can move toward and from a vertical position. It is used for measuring the magnetism of the earth at different places. At most places on the earth's surface the magnetic influence of the earth will prevent the needle from remaining horizontal, but will cause it to



DIPPING NEEDLE

dip in proportion to the power of magnetism exercised. At the magnetic equator alone will the needle retain a horizontal position. It would probably assume a vertical position at the north and south magnetic poles.

DIPTERA, *dip' ter a,* a word derived from the Greek, meaning *two-winged,* is the name of one of the largest orders of insects. It includes flies, the troublesome gnats, midges and mosquitoes. See INSECT.

DIREC'TORY, in French, **DIRECTOIRE,** the executive body appointed in 1795 to control the political destiny of France. It was composed of five members, called Directors, one of whom retired each year to make way for a new member. Already unpopular by reason of its management of internal affairs, it met with further disfavor because of the disastrous results of its military policy, and was overthrown by Napoleon in 1799. It was succeeded by the Consulate, with Napoleon as First Consul. See NAPOLEON I.

DISCI'PLES OF CHRIST, a religious body which originated in Western Pennsylvania in the early years of the nineteenth century, with the idea of securing Christian union by the

restoration of apostolic Christianity, in faith and practice.

The leaders of the movement were Thomas and Alexander Campbell, father and son. Thomas Campbell, a minister, emigrated from Ireland to America in 1807 and settled in Washington, Pa. Grieved at the divided state of the Church, he sought to bring the various branches of the Presbyterian Church in that vicinity into practical fellowship. Incurring the displeasure and censure of his own Church in this effort, he withdrew from its fellowship and organized the Christian Association, composed of those who shared his views. He set forth his beliefs in a *Declaration and Address,* in 1809, in which he urged a return to the New Testament as the only rule of faith and practice, and the only workable basis of Christian union. These views were endorsed by his son, Alexander, who at once became the champion of the plea. The leadership of the movement soon passed from father to son, whose gifts as a speaker and debater secured for him a considerable following.

The first organization was at Brush Run, in Washington County, Pa. As their investigations led them to become immersionists, they allied themselves with the Baptists. But as Mr. Campbell's views were not acceptable to many of that faith, he and his followers were compelled to form independent organizations wherever his teachings were accepted. This separation took place in 1830, and later absorbed similar movements in Pennsylvania and Kentucky. Alexander Campbell became the acknowledged leader, with Barton W. Stone and Walter Scott working in close association with him.

Doctrine. In doctrine the Disciples of Christ, in common with other evangelical bodies, hold to the great fundamental truths of the Fatherhood of God, the inspiration of the Scriptures, the divinity of Christ and the personality of the Holy Spirit. Like the primitive Church, they have no authoritative creed statement. They regard the Bible, particularly the New Testament, as sufficient for guidance in all spiritual matters, and Simon Peter's statement, "Thou art the Christ, the son of the living God," as the true confession of faith. They practice baptism by immersion and the weekly observance of the Lord's Supper, because this was the practice of the apostolic Church. The Church is congregational in government, the different churches coöperating in mission and benevolent work.

The Disciples control a number of schools of high standing, among them Drake University, Des Moines, Iowa; Hiram College, Hiram, Ohio; Transylvania College, Lexington, Ky.; Butler College, Indianapolis, Ind., and Bethany College, Bethany, W. Va., the latter founded by Alexander Campbell. In 1916 they claimed nearly 1,500,000 members, distributed among about 10,000 churches. They have a following in Great Britain, Canada, Australia and in several mission fields, but are most numerous in the United States, especially in the Central and Western states. See CAMPBELL, ALEXANDER. T.W.G.

Consult Gates's *Disciples of Christ;* Campbell's *Christian System.*

DIS'COUNT, a term applied in business to a deduction from a stated price or from a payment due at some future date. *Bank* discount and *trade* discount are the forms commonly used in modern business operations. *True* discount, once in general use, has been almost entirely superseded by bank discount.

Bank Discount is the deduction which a bank makes from the face value of a note for cashing it before it is due. Bank discount is computed in the same manner as simple interest; it is really simple interest, taken in advance. The difference between the face of a note and the discount is called the *proceeds,* and the interval between the day it is presented for payment and the day of its maturity is called the *time of discount,* or *time to run.* The following examples will make clear the principles governing the computation of discount:

Application. Case I. Mr. Brown, on April 1, 1916, presented a three-months' note at a bank to be discounted, or turned into cash. It was dated February 26, 1916, and its face value was $5,000. What sum was paid him, if the bank charged at the rate of 6% per annum?

Three months from February 26 is May 26, date of maturity.

From April 1 to May 26 is 56 days, the time to run.

Discount for 56 days = interest on $5,000 at 6% = $46.67.

$5,000 − $46.67 = $4,953.33, proceeds.

Therefore Mr. Brown received from the bank $4,953.33; that is, the bank charged him $46.67 for cashing his note. The full sum of $5,000 is collected by the bank on the date of maturity.

Case II. The second case involves the discount of an interest-bearing note. Suppose A gives B a note for $450, dated May 5, 1916, payable in 3 months, with interest at 6%. B takes the note to the bank on July 1, and

the bank discounts it at 8%. Find the proceeds and bank discount.

The day of maturity is three months after May 5, or August 5, 1916.

The amount of the note (principal+interest) on August 5, 1916, = the amount of $450 for 3 months at 6%.

Interest on $450 for 3 months (¼ year) at 6% = $6.75.

$450+$6.75=$456.75, amount.

Time to run = number of days between July 1 and August 5 = 31 days + 5 days or 36 days, or term of discount.

Discount = interest on $456.75 for 36 days at 8%.

Interest on $1 for 36 days at 6% = $.006; at 8% it is $.008. Interest on $456.75 = 456.75 × $.008 = $3.65.

Proceeds = $456.75 − $3.65 = $453.10.

Therefore B receives $453.10 on July 1, and the bank collects $456.75 on August 5, the date of maturity. In this case the bank computes the discount on the face of the note plus the interest.

Trade Discount, used generally by manufacturers and wholesale merchants, is the deduction of a percentage from the list price of merchandise. Merchants frequently offer a discount if goods purchased on credit are paid for before the debt becomes due, or a deduction may be made for cash payment. Moreover, after price lists are issued the market value of commodities may fall, necessitating changes in prices from day to day.

The price given in the price list is called the *list price,* and the list price, less the discount, is known as the *net price.* When two or more discounts are allowed, the first discount is deducted, the second is computed on the remainder and deducted from it, and so on.

Applications. (1) If a school board purchases books at 25% off for cash, what is paid for books listed at $100?

100% − 25% = 75%. 75% of $100 = $75, net price; or 25% of $100 = $25, discount. $100 − $25 = $75.

(2) At what price must a merchant mark goods costing $100 so that he may allow a discount of 20% from the marked price and still gain 10%?

Since he gains 10%, his selling price is 110% of the cost. The selling price is also 20% less than the marked price, or 80% of it. 110% of $100 = $110, selling price.

$110 = 80% of the marked price.

1% = 1/80 of $110 = $13.75. 100%, the marked price, = 100 × $13.75 = $137.50, the price at which the goods must be marked.

(3) Goods listed at $180 are sold at discounts of 10% and 5%. What is the net price to be paid?

100% = list price. 100% − 10% = 90%.

90% = new list price. 5% of 90% = 4.5%.

90% − 4.5% = 85.5%, selling price.

85.5% of $180 = $153.90, net price. D.M.W.

DIS'CUS, Throwing the, an athletic exercise regarded by the ancient Greeks as one of the important tests of an athlete. The discus was a round plate of metal or stone, twelve inches in diameter, weighing four pounds seven ounces. The athlete stood in a marked space nine feet square and cast the discus somewhat as a modern quoit is thrown. One of the most remarkable statues in the world is that of the *Discobolus,* or *Discus Thrower,* made in bronze by the Athenian sculptor Myron, in the fifth century B. C. The athlete is seen with every muscle tense, just as he is about to hurl the discus. This statue has been extensively copied, one of the finest examples in marble now being in the Vatican at Rome.

THE DISCOBOLUS

After the statue by Myron. The discus thrower is shown at the moment of highest tension and, at the same time, the moment of rest.

THE MODERN DISCUS

Modern Discus-Throwing. When the Olympic Games were revived at Athens in 1896, contests in discus-throwing were introduced, and from that time the sport has been popular, both in Europe and in America. The modern discus, to conform to official regulations, must be of hardwood and must weigh four and one-half pounds. It is eight inches in diameter and two inches thick at the center, and is bound around with a ring of steel. Discus-throwing appeals to a far larger number of young athletes than does shot putting or throwing the fifty-six-pound weight, for the muscular strain required is much less. Proficiency is a question of "knack" rather than of great strength.

The discus thrower stands in a seven-foot circle, outside of which he is not allowed to step. The discus lies flat against the palm of his hand, and is merely held lightly in place and not grasped with the fingers. After a few preliminary swings and a rapid turn of the body the thrower releases his hold and the

discus sweeps through the air. A distance of 140 feet is a fair average for a trained athlete to make in throwing the discus. There is little or no danger of a beginner tiring himself or subjecting himself to undue strain by constant practice, and an expert can hurl the discus all day without becoming tired. It is therefore an exercise that has much to commend it.

DISEASE, *di zeez'*, a state of ill health not caused by old age. It exists among all forms of life, both animal and vegetable. The natural and normal state of any living thing is good health, when all the organs are in good condition and perform their functions in a normal way. An abnormal state, or ill health, exists either when the actual tissues of an organ are affected or when the organ is unable to work properly. Diseases, therefore, are roughly classed as *organic* and *functional*. In organic diseases, such as appendicitis or tuberculosis, the tissues of the organ become diseased and in course of time may degenerate; in functional disease, such as measles and nearly all other fevers, the organs are disturbed as the result of changes elsewhere. Frequently organic and functional disorders exist side by side.

Disease in the Human Body

Modern medicine divides the causes of disease into two groups; first, those which exist in the body, and second, those which are external. Primitive people always believed that disease was caused by external agencies. Their beliefs seem strange and often fantastic to us. The American Indians, for example, thought that disease was simply a manifestation of an evil spirit; they usually tried to frighten away the spirit by noise or by charms and incantations. Their medicine-man was supposed to be particularly endowed by the gods and to have great influence with the spirits. In our own day there are schools of science which regard disease as evil, and as curable either wholly or in part by will power or external mental influence.

During the Middle Ages, and indeed until comparatively-recent times, many diseases were believed due to an excess of blood, and the most common remedy was to let some of the blood run out of the body. Ordinarily the sicker the person was, the more blood he had to lose—a principle which saved few lives. In the course of time all disease was recognized as due to natural causes, but the nature of these and their treatment is still a matter of controversy. For further details, see MEDICINE AND DRUGS.

Germ Theory of Disease. As early as the seventeenth century the theory was suggested that disease was sometimes caused by the entrance of foreign organisms into the body. It was not until about 1876, however, that the experiments of Koch, Pasteur, Tyndall and others established the fact beyond dispute.

According to the accepted theory, many diseases are caused by *germs*, which are minute organisms of a vegetable nature. This curious fact is usually misunderstood; germs are a form of vegetable life, not of animal life. The tiny organisms, which enter the body in a number of ways, cause chemical changes. These changes in turn produce poisons which cause the obvious signs of disease, such as fever, delirium, depression, nausea and convulsions. The poisons also prevent the organs from working properly and thus cause disease. To prove positively that a disease is caused by germs it is necessary to prove three facts:

(1) A certain germ must always be found in connection with the disease in question.

(2) It should not, as a general thing, be found in other diseases.

(3) It must be possible to make a pure culture—that is, to grow this germ entirely apart from any other germs. This culture must be able to inoculate animals with the disease.

The most important diseases that have been proved to be germ diseases are anthrax, diphtheria, influenza, leprosy, meningitis, pneu-

monia, infantile paralysis, tetanus, typhoid fever and tuberculosis. There are a few others which have some of the characteristics of germ diseases, but their nature is still in doubt. Among these are measles, smallpox and whooping cough. See BACTERIA AND BACTERIOLOGY.

Modern investigation seems to point to the fact that every infectious or contagious disease is due to some germ, and that each disease is produced by only one kind of germ. A disease cannot arise until the germ has entered the body. Every germ disease, therefore, must be preceded by another case of the same disease. In this fact lies the hope and the suggestion of a method for lessening, if not of completely exterminating, such diseases. If the particular microbe of each disease is discovered, the conditions which make its further existence possible can be studied. The information gained would make it possible in almost every case to prevent the development of the germs in the body. Even in those diseases which still baffle science, the presence of germs has led to steps for preventing the spread of the disease. Isolation hospitals are the principal means for preventing epidemics, but the use of antiseptics is also noteworthy (see ANTISEPTIC). In fact, the discovery that wounds and cuts could be saved from infection by cleanliness and antiseptics was one of the greatest advances made by modern medicine.

Germs in the Human Body. The human body is continually at war with all kinds of germs, and it is only when its defenses are broken down that the germs can attack the interior of the body. The strongest defense that the body has is the skin. Under normal conditions it is practically impossible for a germ to pass through the skin into the body. If, however, there is a cut, or a scratch, or any kind of an abrasion on the skin, there is an easy opening for invasion.

There are other openings of the body that offer easy access. Most germs enter the system through the mouth, the nose or the eyes. These are all lined with mucous membrane, which is very easily infected. Once the germs do get into the body they usually increase rapidly in numbers, and unless their growth is checked they destroy the tissues or produce poisons, technically called *toxins*. The blood can rebuild the tissues, if the person is strong enough, and the white corpuscles in the blood help to destroy the poisons. The blood itself and the pores of the skin also carry off some of the toxic, or poisonous, products. J.H.K.

Diseases of Animals

Animals are subject to many of the diseases which afflict man, pneumonia and tuberculosis being prominent among them. Animal diseases may be classed under five heads, as follows:

1. **Infectious Diseases.** Among these are anthrax, cattle plague, dog distemper, hoof and mouth disease, fowl cholera, hog cholera, rabies and tuberculosis. These are generally regarded as the most dangerous of animal diseases, because whole herds may be affected. In many cases the animals die, and in others they must be slaughtered to prevent the spread of epidemics. The origin and cure of many of these infectious diseases are still unknown, and it is noteworthy that cleanliness and perfect sanitation do not prevent them. Special care should be taken to prevent infectious disease among milch cows, because their milk is almost sure to be diseased and to cause sickness among human beings who drink it.

2. **Poison Diseases.** Many animals are poisoned by mineral substances, such as arsenic, copper, lead, phosphorus, mercury and zinc. The result of such poisoning is usually death. Then, too, though it may seem strange, there are many plants or plant products which poison animals. Among these are opium, strychnine, hemlock, larkspur and the famous loco-weed. A "locoed" horse, for example, may die or simply run wild and become useless. Snake-bites and bee-stings are also poisonous, to a greater or less degree, to all animals.

3. **Constitutional Diseases.** Under this head are classed such diseases as diabetes, scurvy and a few other diseases, all of which also affect human beings. They are far less common than the infectious or poison diseases.

4. **Organic Diseases.** This class comprises all diseases, such as pneumonia, which affect the organs. Heart disease and various disorders of the digestive system are common. Some organic diseases are also infectious.

5. **Diseases Due to Parasites.** Almost every species of animal, especially when domesticated by man, is subject to the attacks of parasites. Domestic animals usually have worms in larger or smaller numbers, but it is only when they become numerous that their presence affects the general health. Tapeworms cause nodular

disease of fowls, and trichina causes trichinosis of hogs. The latter, like many other diseases, may attack man. Sheep are particularly susceptible to worms, and many flocks are destroyed by the lung and stomach worms and by the fluke-worm, which affects the liver. Mange in all animals is caused by a tiny parasite, the mite (see MITES). There are a few flies, notably the horse-fly, the screw-worm fly, which spend short lives as parasites. Some ities of these fly-parasites ha but usually they merely cause temporary depression due to Ticks and fleas are also extr but not usually dangerous.

Diseases of Plants

It has been only in recent years that the importance of plant diseases as related to agriculture and to general economic conditions has been recognized. Millions of dollars are lost each year through rust and other diseases. Wheat, potatoes and grapes are among the crops which seem to suffer most. The easiest way to learn the chief facts about plant diseases is to divide them, according to their causes, into four groups. Diseases are due to (1) fungi; (2) bacteria; (3) insects; (4) functional disturbances.

1. **Fungi.** The diseases due to fungi (which see) are the commonest and most destructive. Practically every living thing in the vegetable kingdom is susceptible to fungi, either through the roots, leaves, stem or fruit, and sometimes through all of them. The seeds or spores are tiny, and are carried everywhere by the winds, which thus spread the disease. The method of attack varies. Some fungi, usually called wound-fungi, can enter the plant only through a bruise or cut in the skin. Some irritate the plant's skin and cause fermentation, which dissolves an opening, and still others worm their way through the pores. Once the fungi get a footing, the disease spreads rapidly, either stunting the plant or causing knots, warts or other peculiar swellings. Some of the best-known fungi are potato rot, smut or rust, grape rot, mildew and scab.

2. **Bacterial Diseases.** These are usually and quickly fatal. The only way to prevent an epidemic is to destroy any infected plant as soon as the disease becomes evident. The bacteria enter the plants at any part, and spread rapidly through the entire structure. The blight of pears, cabbage rot, brown rot of potatoes and tomatoes and various diseases of corn, celery and apples are of bacterial origin. Until recently the bacterial nature of these diseases has been disputed, but is now generally acknowledged.

3. **Diseases Caused by Insects.** Plants in ...houses or under other artificial culture are more likely to suffer from plants growing under natural co plants, however, are attacked eases, even when growing unde tions. Phylloxera, which atta grape vines, is the worst of th year it lays waste many rich Germany and other. Euro Aphides and eel worms are oranges, cucumbers, roses, carn plants. See PHYLLOXERA; APH

4. **Functional Disturbances.** nically known as diseases due causes. In other words, they ference with the normal functi Too much or too little water, the commonest of these cause affect the whole plant and The remedies for the diseases only problem is to find out wrong with the plant.

Consult Newman's *Bacteria Health;* Muir and Ritchie's *Man ogy.* For plant diseases, consu *eases of Cultivated Plants and T* diseases, Mayo's *Diseases of Ani*

Related Subjects. The follo these volumes deal either with or with some topic closely relat one of disease, all relating to th

Abscess	Cancer
Adenoids	Canker
Anaemia	Catalep
Angina Pectoris	Catarac
Aphasia	Chicken
Apoplexy	Chilblai
Appendicitis	Cholera
Asphyxiation	Cirrhos
Asthma	Colds
Astigmatism	Colic
Atrophy	Corns
Bacteria and Bacteriology	Cough
	Croup
Baldness	Dandru
Blindness	Delirium
Boil	Diabete
Bright's Disease	Diphthe
Bronchitis	Dropsy
Bunion	Dyspep
Burns and Scalds	Eczema

Elephantiasis
Epidemic
Epilepsy
Erysipelas
Fainting
Fever
Frostbite
Gangrene
Gastritis
Goiter
Gout
Hay Fever
Headache
Hernia
Hiccough
Hives
Hookworm
Hydrophobia
Hysteria
Immunity
Infantile Paralysis
Infant Mortality
Influenza
Insanity
Insomnia
Itch
Jaundice
Kleptomania
Laryngitis
Lead Poisoning
Leprosy
Lockjaw
Locomotor Ataxia
Lumbago
Lunacy
Lupus
Malaria
Measles
Meningitis
Monomania
Mumps
Myopia
Nausea
Nephritis
Neuralgia
Neurasthenia
Neuritis
Neurosis
Neurotic
Nightmare
Palpitation of the Heart
Paralysis
Parasitic Diseases
Pellagra
Peritonitis
Plague
Pleurisy
Pneumonia
Putrefaction
Quinsy
Rheumatism
Rickets
Ringworm
Saint Vitus's Dance
Scarlet Fever
Scrofula
Scurvy
Seasickness
Sleeping Sickness
Smallpox
Spasm
Squinting
Sunstroke
Tic Douloureux
Tonsilitis
Trichina
Tuberculosis
Tumor
Typhoid Fever
Typhus Fever
Varicose Veins
Vertigo
Vomiting
Whooping Cough
Wounds
Yellow Fever

See, also, related lists under AGRICULTURE, subhead *Animal Diseases;* ANATOMY, and MEDICINE AND DRUGS.

DISINFECT'ANTS, certain substances which possess the power of destroying disease germs. The term is derived from two Latin words meaning *without infection.* In cases of sickness of an infectious nature such as diphtheria, scarlet fever, typhoid, measles, smallpox and others, the greatest importance is attached to the thorough disinfection of everything that has been used by or brought in contact with the patient. One of the most reliable, most easily obtained and cheapest disinfectants is *chloride of lime.* A mixture of six ounces of the chloride in a gallon of water will be found sufficiently powerful to destroy virulent germs in thirty minutes. *Carbolic acid* is widely used, but demands great care in handling. *Cresol,* a product of coal tar, is now regarded as a very reliable disinfectant. *Formaldehyde* is also effective, and may be used in powdered form or as a gas (see FUMIGATION). For cleansing and purifying sinks, drains and water pipes a solution of *permanganate of potash* proves valuable. Surgeons' instruments are sterilized, or disinfected, by exposure to formaldehyde gas or by boiling in water to which a little *bicarbonate of soda* has been added. Another practical and useful disinfectant is *iodine.* See ANTISEPTIC; DISEASE.

DISRAELI, *diz ra'li,* BENJAMIN, Earl of Beaconsfield (1804-1881), a great English statesman and author, the only Jew who has been Prime Minister of Great Britain. He was the eldest son of Isaac Disraeli (1776-1848), a well-known man of letters, who, with his entire family, renounced Judaism in 1817 and was baptized into the Church of England. After an indifferent schooling young Benjamin worked from his seventeenth to his twentieth year in a London solicitor's office, and was then in 1824 entered at Lincoln's Inn to study law. That profession, however, proved distasteful to him, and with the encouragement of several literary friends he completed a novel, *Vivian Grey,* which was a success. It won for him an entry into the most exclusive literary and social circles, and made him, at the age of twenty-two, the hero of the hour.

DISRAELI

During the next decade Disraeli continued to write at intervals, and he also entered political life. In 1837 he was elected to Parliament as a Tory, having been unsuccessful in several previous attempts, and within three weeks after his entrance he attempted a speech on an Irish election petition. With his foppish clothing, his fantastic speech and extravagant gestures, he presented a ludicrous figure, and the House laughed him down; but before taking his seat he exclaimed, "I shall sit down now, but the time is coming when you will hear me." Meanwhile, he had not turned from literature, through which he continued to voice his political principles. In the novels *Coningsby* and *Sybil,* noteworthy for the brilliant character pictures, thinly disguised, of public men of his day, he urged adoption of the reform program

advocated by the Young England party, of which he was a member and in later days the leader.

In his early years in politics he was a rigid protectionist, and in 1846, when Peel advocated the repeal of the Corn Laws, Disraeli attacked him in many bitter speeches. Later he abandoned his protectionist principles, stating by way of apology that he thought the needs and feelings of the nation had changed. His first official position was that of Chancellor of the Exchequer, which he held in 1852 and three times subsequently, and in 1868 he succeeded the Earl of Derby as Prime Minister. Shortly after he took office his party was defeated at the elections, but he was again in power from 1874 to 1880.

As Prime Minister. One of Disraeli's earliest acts as Prime Minister was to introduce certain of the reforms, such as poor laws and factory legislation, which he had advocated in his novels. The most noteworthy feature of the administration, however, was its imperialistic foreign policy. The purchase of the Suez Canal shares, the proclamation of Queen Victoria as Empress of India, and the thwarting of Russia in 1878 in its designs on Turkey were the most memorable acts of his Ministry. In 1876 he was created Earl of Beaconsfield.

His Character. Disraeli's personality has always remained more or less of a mystery. In his own day there were few, if any, who pretended to understand his character, and students of his life have been baffled at every turn by apparently inexplainable acts or characteristics. This is perhaps best explained by the fact that, devoted as he was to England, he was in no sense an Englishman, but was Oriental in his ideals and tastes and in the theatrical touch which was evident in everything he did. No public man of his generation, however, left a stronger impression on the popular mind of England or has been remembered with more lasting affection. The anniversary of his death, April 19, is still celebrated in England as "Primrose Day"; the primrose, for some unaccountable reason, is popularly supposed to have been his favorite flower. W.F.Z.

DISTEM'PER, an infectious and contagious disease which attacks various animals, and causes the death, especially of many young dogs. Animals over three years old are rarely affected. It is caused by a germ which produces catarrhal inflammation, and is found in the lungs, nose, eyes and nervous systems of animals. The symptoms of the disease vary according to the organ in which it settles. The first signs of distemper, however, are loss of appetite, fatigue, trembling, chills and a dry, hot nose. Other and later symptoms are watery and inflamed eyes, sneezing, itching of the nose, coughing, restlessness, red spots on the skin and loss of weight.

Treatment. To check and cure the disease, the animal should be placed in a clean, warm place free from draughts, and be carefully nourished with milk and strong meat broth in which the yolk of an egg has been beaten. According to the organ especially affected, various other measures must also be taken. If the eyes are inflamed they should be washed with a five per cent solution of boric acid or a one per cent solution of carbolic acid. If the digestive tract is affected one-grain doses of calomel three times a day bring relief. For coughing, two grains of compound licorice powder two or three times a day will be found effective.

Horses, mules, cats, wolves, hyenas and monkeys are also subject to forms of this disease. If domestic animals are attended to at the first sign of infection, warmth and careful nourishment will effect a cure.

DISTILLATION, *dis ti la' shun.* That water left exposed to the air will disappear by drying up is a familiar fact. The warmer the water the more rapidly will it "dry up," but when this happens the water is not annihilated. It has simply changed into a gas, that gas which we call *water vapor,* or *steam.* The word *evaporation,* applied to the drying up of water, is a very appropriate one. When water is boiling it forms the same gas. The clear space just above the spout of a boiling kettle is filled with this water vapor. The cloud which we see above the clear space consists of droplets of water, which have been formed by the cooling of the gas. We say that the gas has *condensed* into liquid water. In the ordinary boiling of a kettle of water, however, not all of the water vapor by any means condenses into liquid droplets; even many of the droplets which are formed evaporate again if the air of the room is warm and dry. If we invert a cold milk bottle or fruit jar above the spout of the kettle, a larger proportion of the gas will condense, and we may be able to collect enough of the condensed water to drop or run in a little stream from the mouth of the bottle. A still larger quantity will be obtained if we arrange to keep the bottle cool by wrapping a wet towel around it.

The process of boiling a liquid, such as water,

and condensing the vapor which it forms is called *distillation*. In the above example, the water collected in the milk bottle is *distilled water*. Distillation, it will be noted, embraces the two processes of *evaporation* and *condensation*. Water is sometimes distilled to purify it. If the original water contains salt (or any other substance) that does not evaporate at the boiling temperature, that substance will remain in the kettle. The distilled water will not be salty. The natural purification of water by distillation is constantly proceeding on a grand scale. Water is evaporated from the sea, from the soil and from the leaves of trees and plants. The water vapor so formed is recondensed into clouds and mists and dew. Rain and dew are forms of naturally-distilled water.

The apparatus for distilling is called a *still*. It has three essential parts: (1) the *boiler*, or receptacle to hold the liquid after distillation; (2) the *condenser*, in which the vapor is cooled to reconvert it into liquid; (3) the *retort*, in

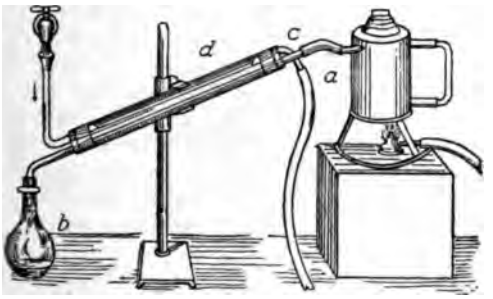


FIG. 1

In this kind of still *a* is the boiler, *b* is the retort for collecting the distilled liquid, *c* is the pipe leading from *a* to *b*, and *d* is the condenser, through which the tube *c* passes, surrounded by running cold water.

which the distilled liquid (the distillate) is collected. In our experiment the kettle was the boiler, the cooled bottle the condenser, and a glass held under the mouth of the bottle would constitute a retort. The accompanying diagram (Fig. 1) shows the parts of a simple still. In large stills the condenser usually consists of a long pipe coiled in a spiral and immersed in a tank through which cold water is constantly running (Fig. 2).

Fractional Distillation. As a rule it is not possible to separate two liquids by a simple distillation. Although alcohol, for instance, boils at 172° F. (forty degrees below the boiling point of water), water will evaporate fairly rapidly at that temperature. If, then, we boil a mixture of alcohol and water and condense the vapor, the product obtained will contain water as well as alcohol. But the distillate collected *at the first* will have a much larger proportion of alcohol than the liquid in the retort. So by collecting the distillate in *fractions*, we can partially separate the two liquids. By redistilling each of the fractions we can carry the separation further. Fractional distillation is made use of in distilleries, and the proportion of alcohol in *distilled liquors*, such as brandy, whisky and rum, is always much greater than in liquors (such as wines and beers) made without distillation.

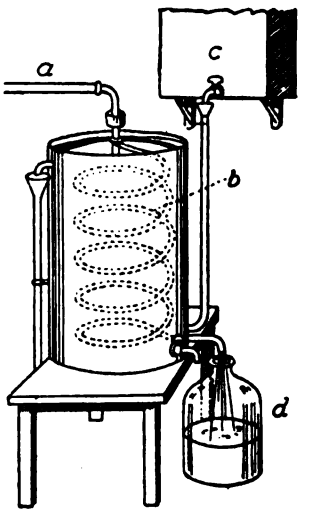


FIG. 2

In this larger condenser *a* is the pipe leading from a boiler; *b* is a coil of pipe called the *worm*, and it is surrounded by cold water which flows into the vessel from the tank *c*; *d* is the retort for receiving the distilled liquid.

Petroleum refining is another industry in which fractional distillation plays a very important part. Petroleum (which see) is a mixture of a great many substances. By fractional distillation it is separated into a number of fractions, which are used for different purposes. The first fractions obtained in distilling petroleum are naphtha and benzine. Next comes gasoline, afterwards kerosene, and then heavier oils which are used as fuels or for lubricating machinery. All of these fractions are still mixtures of different substances, but the original, very complex mixture has been sufficiently separated to yield a number of useful products. In a similar manner a number of useful products are obtained from *coal tar*.

Destructive Distillation. In simple distillation and in fractional distillation, no new substances are formed. Those present are merely separated, completely or partially. The term *destructive distillation* is applied to processes in which new substances are produced. When wood is heated in closed boilers, charcoal, acetic acid, wood alcohol and acetone are produced, together with water and some gases. When coal is similarly treated, coal gas, ammonia, coal tar and coke are obtained. These

substances were not present in the original coal or wood. They have been produced by the decomposition of the substances originally present. Destructive distillation is therefore a chemical process, while simple and fractional distillation are purely physical. J.F.S.

Related Subjects. This topic may be followed further by reference to the topics in these volumes which are named below:

Acetic Acid	Coke
Alcohol	Gas
Carbon	Gasoline
Charcoal	Petroleum
Coal	Wood Alcohol
Coal Tar	

DISTILLED LIQUORS, those alcoholic liquors which are manufactured by fermentation and distillation. Most of the common distilled liquors, such as rum and whisky, are made directly from corn, wheat and other grains, or from potatoes. The grain is ground and soaked in warm water, forming *mash*. Yeast is then added, and the mash is allowed to ferment, forming *wort*, from which the spirit is distilled. The first product contains impurities from which the spirits are separated by re-distillation. The purification is generally known as the process of *rectifying*. Brandy is made by distilling wine. The production of distilled liquors in most countries of the world is an extensive business, but one which is steadily decreasing in volume. Including commercial alcohol, it amounts in the United States to about 194,000,000 gallons a year, and the revenue derived from it by the government is about $160,000,000 a year. Peoria, Ill., is the largest manufacturer of distilled liquors in the world, and the revenue paid by the distilleries of that city to the United States previous to 1915 was more than enough to build the Panama Canal.

Canada manufactures about 6,500,000 gallons of distilled liquors per year, from which the Dominion derives a revenue of nearly $9,500,000. See WHISKY, BRANDY, RUM, and other liquors of common manufacture; also INTERNAL REVENUE; DISTILLATION.

DISTRICT OF COLUMBIA, the official name of the seat of government of the United States. It occupies a tract of land ceded by the state of Maryland, containing about seventy square miles on the north side of the Potomac River, about 100 miles from its mouth and forty miles southwest of Baltimore. The District originally included also about thirty square miles ceded [redacted] state of Virginia, in which is the present [redacted] Alexandria. Georgetown and Anacostia were included in the Maryland grant. The latter is said to have been the site of the famous Indian village of Powhatan, visited by Captain John Smith in 1608. The scenery of the District back from the river is very picturesque. The climate is mild, but is subject to violent changes of temperature.

The population in 1800 was 14,000; in 1910 it was 331,000, of which about 100,000 were colored. According to an estimate of the Census Bureau, it had a population of 363,980 in 1916.

Government. The present form of government in the District of Columbia was inaugurated in 1878. The governing body consists of three commissioners, who devote their entire time to the public service. They are selected

DISTRICT MAP
(*a*) National Park.
(*b*) Naval Observatory.
(*c*) Soldiers' Home Park.
(*d*) Arlington National Cemetery.

by the President, with the approval of the Sen[redacted] ate. Two are chosen from civil life and hold [redacted] office three years; the third is an officer of the [redacted] corps of engineers of the United States army [redacted] with a term of office not exceeding four years [redacted] Congress passes all laws for the control of the [redacted] District. Half the expenses of the governmen[redacted] are paid by Congress, the remainder by loc[redacted] taxation.

The District was organized solely as the se[redacted]

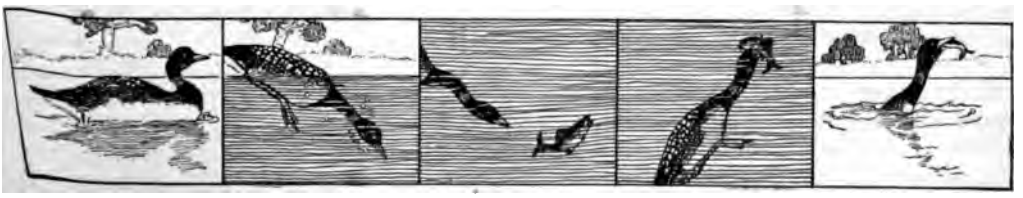
of the national government, and the people residing in it have no vote. Government employees retain their former places of residence for voting purposes, and many of them travel long distances to vote at important elections. So that they may not lose all influence in their local affairs, the citizens have formed a number of associations which discuss municipal needs. These they present to Congress with petitions, which usually exert considerable influence on that body. In February, 1917, after years of effort, Congress passed a law making the District prohibition territory, the measure to take effect November 1 of the same year.

History. Shortly after the Revolutionary War the Congress of the young republic found it necessary to secure a place in which to establish a permanent home for the government. There were several important offers made, but it was not until July 16, 1790, that Congress voted to accept the tract on the Potomac. Of this land Maryland ceded 69.25 square miles and Virginia 30.75 square miles. George Washington, then President, was authorized to select the site for the Capitol, anywhere between the mouths of the Conogocheague and the eastern branch of the Potomac. Commissioners were appointed in 1791, and Major L'Enfant, a French engineer, was employed to draw up plans for the capital city. This he did on such a far-seeing scale that Washington is to-day one of the most beautiful cities in the world. The commissioners christened the Federal District the "Territory of Columbia" and the capital the "City of Washington." The district was divided into two counties—Washington (Md.) and Alexandria (Va.). Later the name was changed to District of Columbia.

In December, 1800, Congress held its first session in the new Capitol. The first President to be inaugurated in Washington was Thomas Jefferson, in 1801. Mr. Jefferson was very democratic, and it is recorded of him that on the day of his inauguration he rode unattended to Washington, tied his horse to the fence of logs and entered the Senate chamber alone to take the oath of office. In the course of time the great buildings necessary for conducting the government were erected; but as they were all on the Maryland side of the Potomac, the people of Virginia became dissatisfied and asked that the tract of land they had donated be returned to them, which was done in 1846. In 1895 the city of Georgetown became a part of the greater city of Washington. K.A.G.

DIVER, or LOON, is a name given to a number of water birds which are skilful divers, especially those related to grebes. Loons, or *great northern divers,* breed from the Northern United States to the Arctic Circle, and most small, lonely, interior lakes within that zone have at least one or two pairs of loons during the summer. They are about thirty-six inches long, with black backs and wings spotted with white, their heads and necks being glossy black and green, the latter with a collar of white streaks. The tails are short, but well formed; the feet are black and webbed. They are really the largest and handsomest of diving birds, but their uncanny screams, sometimes resembling rough, jeering laughter, are far from musical, and suggested the name *loon,* although they are by no means stupid. The slang phrase *loony* was not derived from the name of this bird, as many suppose, but from the word *lunatic.*

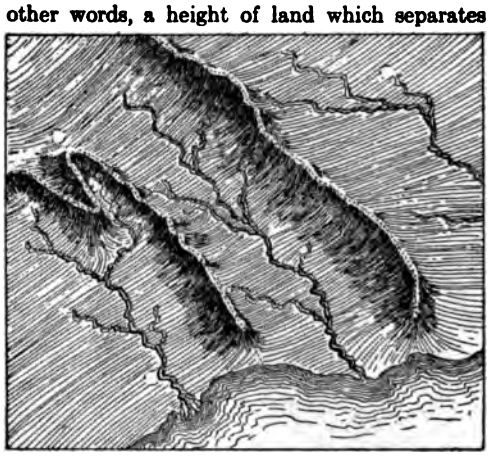
THE DIVER, OR LOON



HOW THE LOON GETS HIS DINNER

These birds feed chiefly on fish, for which they dive. Their flesh is dark and tough, but they are sometimes killed for food. The *black-throated loon* is smaller than the *great northern diver* and has a throat entirely black. It is very common in Canada. The *red-throated diver,* only about twenty-five inches long and of duller coloring than the loon, is also a common species of diver, and in Scotland is called the *rain goose.*

DIVIDE', in physical geography, is the name given a crest of land, or water-parting, which separates the streams flowing into one main river from those flowing into another; or, in other words, a height of land which separates



ILLUSTRATING TWO DIVIDES

the headwaters of one river system from another. It is also called a *watershed.*

A divide may consist of low land, like the Height of Land, which extends across the great plain in North America and separates the rivers flowing into Hudson Bay from those flowing into the Mississippi basin, or it may consist of high land with steep slopes, like the Rocky Mountains, which separate the rivers flowing into the Mississippi from those flowing into the Pacific. On Cutbank Pass in the Glacier National Park one may pour water from a pail into three different rivulets which will carry it into Hudson Bay, the Pacific Ocean and Gulf of Mexico, respectively. This point is actually the top of the American continent. There are several places in America where the beginnings of streams flowing to the Pacific and to the Gulf are within a few feet of each other.

DIVINATION, *di vi na'shun,* is the practice of determining the issue of events by signs and [redacted] and by lot or systems of fortune-telling rests upon the assumption that human [redacted] osely related to the forces of nature in a protective or providential relation, and implies also the view that the reading of nature is to be accomplished by a mystical guessing of its secret meaning. These ideas underlie magic and survive in superstition (see MAGIC; SUPERSTITION). Divination constitutes so large a part of the procedures of magic, of the occult, and of the pseudo-sciences, that information should be sought under these heads. It will be sufficient to survey the types of divination and give a general setting for its varied practices, constituting as they do one of the most comprehensive and suggestive reactions of the primitive mind (and of earlier forms of thinking) to the events of the material and spiritual world.

The division is fairly clear between natural and artificial forms of divination, the latter patterned upon the former and in course of time giving rise to elaborate systems. The natural varieties of divination proceed upon omens and portents in the course of nature, the conception being that the intervening gods or spirit-forces indicate the issue. The direct search for such inspired messages led to the institution of oracles, in which, as in the Delphic oracles, the god spoke directly through the inspired medium (see ORACLES). More artificial was the institution of augury, which, as the word indicates, detected the omen in the flight of birds. Dreams seem to have been generally regarded as prophetic, and their interpretation became one of the arts of the priest-magician or seer. Oracles and dreams leave much to the imaginative skill of the interpreter; the oracular pronouncement was typically vague, capable of several interpretations, and thus was at once shrouded with an air of mystery and left room for the later adjustment of the issue to the prophecy.

The unsought portent or omen remains the type of the natural divination, in a primitive sense providential. The appearance of a comet, of a storm, of an eclipse, of a volcanic eruption, or again, the shapes of clouds and the movements of swarms of insects were directly read as omens or warnings; similarly, the appearance of a flock of birds would indicate the fate of an expedition. The sight of a hawk would presage victory; of a crow, defeat; birds appearing to the left would have one meaning; to the right, another; their flight in one direction would be lucky; in another, unlucky. The hoot of an owl would be a bad sign, the cry of an eagle, a good sign. Any accident would be similarly interpreted. A typical instance is

the familiar one of the Roman general who stumbled as he stepped upon the shore of a land he sought to conquer; this would be a bad omen, but he made it a good one by treating the misstep as intentional, with the words, "I salute thee, mother earth." Xenophon mentions the incident that during an assembly some one sneezed, which was taken as a favorable omen for the matter under advisement. The tendency to systematize omens led to more and more artificial devices, while their incorporation into the general systems of magic made of divination an elaborate art.

When advice is sought for a particular issue which is in doubt, the appeal to lot follows; yet the answer is not regarded as chance but as directed by hidden forces of a magical nature. Such procedure may involve the method of representation or symbol; thus a tree is planted at the birth of a child, and by its growth is divined the growth or early death of the child. Similarly, a set of arrows may be set up in the wind, each representing a young brave, and the one whose arrow falls last is chosen as leader. The casting of lots by bones out of which grew dice, by spinning of cocoanuts (a primitive roulette) and the use of cards as a means of deciding issues have a further interest in that they appeal to the gambling instinct, which is also ancient and widespread. That gamblers are proverbially superstitious about their luck may point to an underlying common habit of mind. But divination develops many varieties in which the "religious" implication persists; of such nature is the pricking for texts in the Bible, to indicate desirable or timely decisions. Names for baptism might be selected in this way; though superficially resembling the custom obtaining among primitive people, who thus try to determine which ancestor has returned in the newborn child, the custom has obviously a different social status.

Divination leads to fortune-telling in general. The use of cards is typical. By attaching one fate to each of the four suits and further varieties of fortune to each of the faces, endless combinations are possible and all sorts of issues in love, in business, in travel, in speculation, in life, in health and disease, in recovering lost articles, may be provided for. Similarly, all the varieties of objects and incidents that occur in dreams, by far-fetched analogy and an artificial distribution of fate, may become signs of what is about to happen (see SUPERSTITION). Whether referred to dreams or to daily life, the divining habit attaches significance to trivial incidents; spilling salt, stubbing one's toe, stepping on cracks, forgetting an article of attire, getting up with the left foot foremost, and also such playful customs as pulling petals of daisies to see whether "he loves me" or "loves me not," the lore of hang-nails and the various divinations (in teacups, in the flame of candles, in melted wax) that are used on Hallowe'en (the night when spirits return to earth) illustrate the vestiges of beliefs in divinations. The systematic forms of fortune-telling embody in crude and distorted manner the lore of astrology and the related pseudo-sciences, and have little interest outside of this relation.

A special interest attaches to the forms of divination which play to the subconscious indications of the performer. The best known of these is the *divining-rod* for locating underground water. A forked hazel rod (the details have only a superstitious meaning) is held loosely in the hand as the diviner walks over the ground; and where it dips water will be found. The dipping is due to the subconscious movements of the "dowser" (as he is called in England), to the shrewdness of his reading the surface indications of a proper place for a well, and to the fair chance of finding water rather generally in localities where the practice prevails; also to the neglect of observing failures and the exaggeration of successes, which is the human habit.

Special mention must be given to a form of divination which invites the imaginative fancy of the seer. The reading in a mirror or on the surface of the water issues of events or what is going on at a distance is a power accredited to certain persons in ancient and modern times; it has been given the name of *crystal-gazing* (also *scrying*). Its use in divination was directly to project the future, to see what is going on at a distance and for such concrete purposes as the detection of criminals. That such visions are in reality the projections of a vivid imagery (such as all can command in limited measure with closed eyes) is clear; that their definiteness is aided by the reflection; that the movements seem in a measure independent of the control of the gazer, but actually are contributed by subconscious as well as conscious memories and desires—these considerations give the process a psychological interest. The interpretation of such visions as are prophetic or telepathic rests upon a very different basis. They form pictorial

accompaniments to the current of thought which, as in dreams, may be influenced by undercurrents of desire and anticipation, and thus make plausible the use of the power (which is very unequally distributed) for purposes of divination. J.J.

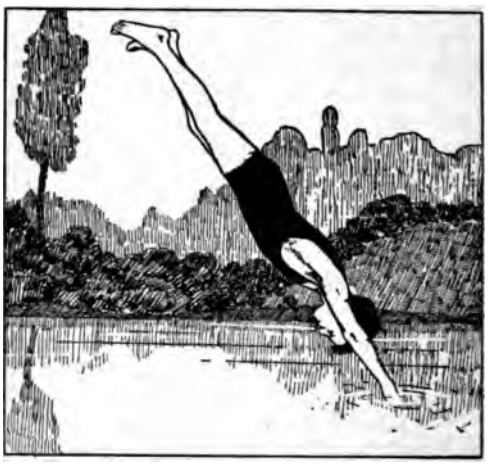
Relating to Various Beliefs. The articles on the following topics, while not bearing on divination, are of interest in this connection.

Alchemy	Palmistry
Astrology	Phrenology
Clairvoyance	Physiognomy
Conjuring	Psychical Research
Demonology	Psycho-Analysis
Faith-Cure	Spiritualism
Hypnotism	Subconscious
Magic	Suggestion
Medium	Superstition
Mesmerism	Telepathy
Mind Reading	Theosophy
Necromancy	Trance
Occult	Witchcraft

DIVINE RIGHT OF KINGS, the belief that sovereigns derive their authority to rule, not from the consent or desire of their subjects, but directly from God, whom they represent; in other words, those who subscribe to such a creed believe "the king can do no wrong." This doctrine reached its highest development in England during the time of the Stuarts, and in France during the reign of Louis XIV. It is still maintained by some in theory, but has ceased to have a practical political meaning, for even in strong monarchies the people are more and more holding their rulers to strict accountability. The term came into use in a general way in the seventeenth century. It has also a religious application, an example being the doctrine of the infallibility of the Pope. See STUART, HOUSE OF.

DIVING. Merely "to plunge into water headforemost" (this is the dictionary's first definition of the word *dive*) does not sound particularly pleasant. But anyone who has learned to dive—or one who has watched boys and girls, and grown-ups, too, dive from a board and clamber quickly out of the water for "just one more turn," no matter how many plunges they have taken—knows that there are few sports more fascinating. Good divers know, too, that nothing gives the individual such perfect control over all his muscles as the repeated effort to dive well.

In a diving contest the judges mark the performers for their proficiency in three things—gracefulness while in the air, ability to enter the water without splashing and ease in emerging from it. Inexperienced divers appear awkward in the air because they hold themselves stiffly in the position in which they leave the board, but a graceful diver seems to move in the air with as much freedom and



A GOOD DIVE

If this boy straightens his left leg, throws his toes even farther back and does not bend his hips until he is completely submerged, he will enter the water with scarcely a splash.

self-control as on land. Smoothness in entering the water comes from holding the body in a straight line from finger-tip to toe's-end. When the body is half under water the back

A POOR DIVE

This boy will splash gallons of water, because his arms and legs are spread apart and his body is bent at the hips.

can be bent and the head and arms pointed upward, but, unless carefully controlled, an upturn started before the feet are submerged will cause the legs to drag.

Deep-Sea Diving. To go down among the fishes and the queer creatures of the ocean

depths, to visit perhaps with the fabled mermaids, must have been thought of as a delightful adventure by boys and girls and their romantic elders for many ages. When men began to sail the seas and ships were often wrecked, there was added the romance of sunken treasure, which even to this day is the chief inspiration of deep-sea diving.

The Diving Bell. In ancient times there were professional divers for recovering wreckage who worked, as do the modern pearl divers of the Orient, without mechanical appliances. But of course they were unable to stay under water more than two or three minutes, and both Greek and Roman historians tell of curious inventions made to enable them to keep at work longer. One of these, the diving bell, is supposed to have been revived by Roger Bacon in 1250. If you turn a dish upside down and push it straight downward into the water, the air inside will be carried down with it, as you may see by the bubbles that come up if you tip the dish slightly; the diving bell was just a huge inverted dish with tubes through which fresh air could be supplied. Men could work inside it for several hours.

How a Modern Diver Works. Before going below the surface, a diver of to-day dons a waterproof suit. At the neck of the suit is a metal ring into which a helmet is screwed. The helmet is provided with windows, to enable the diver to see, and with two rubber tubes; through one of the latter a supply of air is pumped from above, and the other serves to carry off the foul air. The helmet is made of copper. Formerly a diver had to communicate with those above the surface by jerking a rope, but modern diving outfits include telephones. A loud-sounding receiver is placed in the crown of the helmet and a transmitter is fixed between the windows, or eyes, directly opposite the diver's mouth. This apparatus has been so perfected that it is now possible for the attendant above to speak to several divers at the same time and for the divers themselves to be put in direct communication with each other.

To enable a diver to sink to the bottom and to preserve his balance while there, his boots have leaden soles and he wears two sheets of metal weighing about forty pounds each, one over his chest, the other on his back. Each boot weighs sixteen pounds. He also carries necessary tools in a strong leather belt, and is provided with electric lights, either powerful arcs of 3,000 candle power connected with dynamos above, or electric torches supplied with their own batteries.

Until recently it has not been possible for divers to work at a great depth, but in 1907 the British government perfected apparatus which was used 200 feet below the surface, and in 1915, when a torpedo boat sank at Honolulu, divers of the United States navy reached a depth of 288 feet. C.H.H.

DIVISIBIL'ITY OF NUMBERS. When one number can be divided by another, giving no remainder, we say the first number is "divisible" by the second. We sometimes say "exactly divisible," but this is not necessary since "divisible" is used to signify "exactly divisible." The divisor in such cases is called a "divisor" of the number, meaning an "exact divisor"; for example, in $160 \div 8 = 20$, 160 is "divisible" by 8, and 8 is a "divisor" of 160.

Tests for Divisibility. *Divisibility by 2.* A number is divisible by 2 if it ends in 0, 2, 4, 6 or 8; as 20, 18.

Divisibility by 3. A number is divisible by 3 if the sum of its digits is divisible by three; for example, 17841. The sum of its digits is $1+7+8+4+1$, or 21, which is divisible by 3. Here we use the word *digit* to mean the *number for which the digit stands.*

Divisibility by 4. A number is divisible by 4 if it ends in two zeros, or if the number represented by the last two digits is divisible by 4; for example, 700, 132, 86388.

Divisibility by 5. A number is divisible by 5 if it ends in 0 or 5; for example, 80, 65, 700.

Divisibility by 6. An even number the sum of whose digits is divisible by three is divisible by 6; for example, 174, 42726. 174 is an even number; the sum of its digits ($1+7+4=12$) is divisible by 3, and 174 is divisible by 6. $174 \div 6 = 29$. See that the same is true of 42726.

Divisibility by 8. A number is divisible by 8 if it ends in three zeros, or if the number represented by its last three digits is divisible by 8; for example, 16000, 19648, 2048.

Divisibility by 9. A number is divisible by 9 if the sum of its digits is divisible by 9; for example, 27648 ($2+7+6+4+8=27$); 604071 ($6+4+7+1=18$). 27 is divisible by 9, and 27648 is divisible by 9. 18 is divisible by 9, and 604071 is divisible by 9.

Divisibility by 11. Find the sum of the alternate digits beginning with the first digit of the number; find the sum of the alternate digits beginning with the second digit of the number. Find the difference between these sums. If this difference is zero or a number

divisible by 11, the number is divisible by 11; for example, 819192. (8+9+9)—(1+1+2)=22. 22 is divisible by 11; 819192 is divisible by 11. 819192÷11=74472. Another illustration: 455488. The difference between the sums of the alternate digits is (4+5+8=17)—(5+4+8=17)=0, and the number is divisible by 11. 455488÷11 =41408.

Divisibility by 7. The test is so much more difficult than the division itself is, except for very long numbers, that the test is used rarely. It is given below:

Take the last six digits at the right as a number; take the next six digits as a number and so on. Find the sum of these numbers. If the sum is divisible by 7, the number is divisible by 7; for example, 344519,485268.

```
   485268
   344519
7|829787
   118541
```

Since this sum is divisible by 7, we know that the number is. It is seen that for numbers of less than 7 digits, the test has no advantage, and has little, if any, for numbers of more digits.

Casting out of 9's. This is a test used as a check on work in the four fundamental processes. It is open to criticism as a check because it will not show up an error of 9 or any multiple of 9.

Test for Addition. Cast out the 9's from each column, and note the remainders or the excess (as it is called); then cast out 9's from the sum of these excesses. Then cast out 9's from the sum of all the addends. If the excesses obtained in both cases agree, the sum is correct. For example:

```
 694      4+2+6+8=2×9+2
 832
 796      9+3+9+5=2×9+8
 458
2780      6+8+7+4=2×9+7
```

Excesses are 2, 8, 7. 2+8+7=9+8. 8 is the excess after casting 9's from the columns. 2+7+8+0=9+8. 8 is the excess after casting 9's from the sum. The excesses agree. We may cast out 9's from the addends horizontally instead of vertically, as follows:

```
6+9+4=2×9+1
8+3+2=1×9+4
7+9+6=2×9+4
4+5+8=1×9+8
```

Sum of excesses=1+4+4+8=9+8. The excess is 8, and agrees with the excess of the sum as seen above.

Test for Subtraction. Cast out the 9's in th subtrahend, and the 9's in the difference. Ad the excesses found thus and cast the 9's fro the sum. Then cast 9's from the minuend, an find the excess. If this latter excess agre with the former the answer is correct. Th follows from the method in proving additio since the minuend is the sum of the subtr hend and difference.

Test for Multiplication. Cast out 9's in th multiplicand and find the excess; cast out 9 in the multiplier and find the excess; find th product of these excesses and cast out 9's fro it, and note the excess. Now cast out 9's fro the product and note the excess. If these las excesses agree, the product is correct; for ex ample:

```
  98743      (9+8+7+4+3)=3×9+4
   6582
 197486      (6+5+8+2)=2×9+3
789944
493715      4×3=12=9+3
592458
649926426
```

Excess is 3. (6+4+9+9+2+6+4+2+6)= ×9+3. Excess is 3. Excesses agree; produc is correct. We may also test the addition c the partial products as one would test any ad dition.

Test for Division. Cast out 9's in divisor an note the excess; cast out 9's in the quotien and note the excess. Find product of thes excesses; cast out 9's and note excess. The cast out 9's from the dividend and note th excess. If these last two excesses agree th quotient is correct. In case of a divisio which gives a remainder, cast out 9's from th remainder and note the excess obtained. Ad this to the excess obtained after casting 9 from the product of the divisor and quotien and this sum must agree with the excess in th dividend. Problem: Make use of test in prov ing correctness of quotient in example, 7494735 ÷974=76948.

Illustration of first case:

```
    76948
974|74947352     9+7+4=2×9+2
  6818
  6767           7+6+9+4+8=3×9+7
  5844
  9233           2×7=9+5
  8766
  4675
  3896
  7792
  7792
```

Excess is 5. 7+4+9+4+7+3+5+2=4×9+ Excess is 5. Quotient is correct.

Illustration of second case:

```
        1677
274 ) 459636
      274          (2+7+4)=9+4
      1856
      1644         (1+6+7+7)=2×9+3
       2123
       1918        4×3=9+3
        2056
        1918
         138
```

Excess is 3. (1+3+8)=9+3; excess of remainder is 3. 3+3=6. Excess is 6. 4+5+9+6+3+6=3×9+6. Excess is 6. Excesses agree; the quotient is correct.

The 9's are cast out in a shorter way than the work above indicates; for example, in the number 459636, the dividend in the last problem, one sees 9 and cancels it; then sees 4 and 5, then 6 and 3, and cancels them thus ~~459636~~, leaving the excess 6. A.H.

DIVISION, *di vizh' un.* Division comes easily out of multiplication, as shown below:

9×8=72	n×9=54
4×9=36	n×3=27
7×4=28	n×6=48

In the group at the left, we use 8 nine times and have 72; we use 9 four times and have 36; we use 4 seven times and have 28. In the group at the right, someone uses a certain number of 9's and has 54; uses a certain number of 3's and has 27; uses a certain number of 6's and has 48.

Let it be the teacher who does this. She says, "How many 9's did I use?" or "By what did I multiply 9?" and the child, seeing it from the multiplication view, answers "6." The problem appears:

n×9=54
6×9=54

The same method brings answers to the others and they appear:

n×3=27	n×6=48
9×3=27	8×6=48

The question "How many 9's did I use to make 54?" easily becomes, "How many 9's are in 54?" and we have division in form as well as in thought. The problems now are:

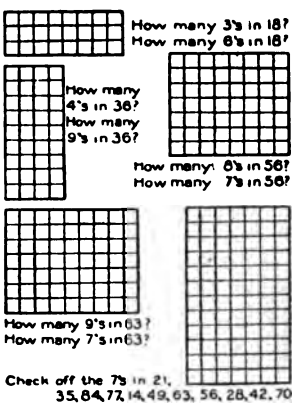
54÷9=n
27÷3=n
48÷6=n

They should be read "How many 9's in 54?" "How many 3's in 27?" and so on, just as the multiplication form, n×9=54, is read. The very technical expression, "54 divided by 9=what?" should not be used too early, and even when used later should alternate with the clearer, more suggestive question, "How many 9's in 54?" This should be used far along into the middle grades.

Much work of this kind will carry multiplication right into division. We may write the two views side by side:

Multiplication	Division
n×8=32	32÷8=n
n×9=27	27÷9=n
n×7=63	63÷7=n
n×5=35	35÷5=n
n×8=56	56÷8=n
7×8=56	56÷8=7
4×n=24	24÷4=n
4×6=24	24÷4=6

With this the transition is made from multiplication to division. It should be accompanied by concrete illustrations; use should be made of blocks, squared paper, etc.



The use of areas on squared paper helps greatly at this place, as shown in the illustration which appears herewith.

Teachers should give opportunity for concrete division to such an extent that the child realizes that he is measuring a quantity of length or space or weight, etc., by finding how many of a definite measure or unit there are in the quantity measured. When the child goes from the concrete problem to figures, he must see that the dividend represents the quantity he is measuring, the divisor represents the measuring unit, and the quotient tells how many of these units there are in the quantity he is measuring. (Quotient means *how many.*)

Home Helps. The parent has excellent opportunity to help the child at home in division. Here there are many quantities to be measured and the child may move about freely and choose his material and discuss the measuring process, and have father or mother help him carry out his work. Some suggestions for home work:

(a) Room 19 feet by 18 feet. Measure with a yard stick. The problem becomes 19÷3=6⅓; 18÷3=6.

(b) Mother buys 2 dozen eggs. She uses 6 for each day's breakfast. Child finds, by count-

ing the eggs in 6's, how many breakfasts 2 dozen will provide. $24 \div 6 = 4$.

(c) A peck of potatoes may be measured off in 6's or 4's or 8's or whatever mother says is the daily average used. The problem may be $50 \div 4$, 6 or 8; the dividend is the number of potatoes in the peck, the divisor the number used per day, and the quotient the number of days a peck will last.

(d) The same may be done with apples.

(e) Child's allowance for a week may be divided into groups of pennies for daily spending.

(f) Divide large groups of pennies into groups of 5, or 6, or 8, etc.

Short Division. We shall see how short division is derived from multiplication:

221	$884 \div 4 = n$
4	
800	4|884
80	200
4	20
884	1
	221

How many 4's in 800? Look at the problem in multiplication and see that we put 200 4's in 800. How many 4's in 80? Look at the multiplication and see that we put 20 4's in 80. How many 4's in 4? One.

So we have in the quotient 221. The teacher here emphasizes that this means there are 221 4's in 884. Another illustration:

321	$963 \div 3 = n$
3	
900	3|963
60	300
3	20
963	1
	321

Another:

$848 \div 4 = n$

(1)	(2)
4|848	4|848
200	212
10	
2	
212	

Read the answer here 200, 10 and 2 to see its agreements with the answer to the left.

As the child writes the answer, he should read it in full; for example in $2\overline{)846}$, the answer 423 is read 4 hundred, as the 4 is written, twenty as the 2 is written, and 3. Then follow easily such problems as these:

3|1200	6|1800	8|2400
400	300	300
4|804	3|1209	7|707
200	400	100
1	3	1
201	403	101

Have the pupils speak and write in full the answers to each division above; as, "How many 3's in 1200?" Answer "400." "How many 8's in 2400?" Answer "300." "How many 4's in 800?" Answer "200." "In 4?" Answer "1." The difficulty which such problems usually present to children is thus cleared away. It helps them to avoid such common expressions as "4's in zero," "3's in zero," etc., which are meaningless to the child.

7|2814	9|3627	6|5442
400	400	900
2	3	7
402	403	907

The above three are typical of another difficulty which is here avoided by this same writing and reading of answers in full. In the first problem the child thinks, "How many 7's in 2800?" He says "400," and seeing 14, says "402." In the second he thinks, "How many 9's in 3600?" and says "400," and seeing the 27, realizes there are 3 more, and says "403."

Division with Reduction. Such division comes from multiplication where there is "carrying" or reduction (see MULTIPLICATION). We shall look at such multiplication and division side by side:

$26 \times 2 = n$	$52 \div 2 = n$
2	
12	$2\overline{)52} = 40 + 12$
40	$20 + 6 = 26$
52	
241	$723 \div 3 = n$
3	
600	$3\overline{)723} = 600 + 120 + 3$
120	$200 + 40 + 1 = 241$
3	
723	

Many simple cases of this kind should be worked out in multiplication and in division, that the child may see that in division he is taking apart a number along the lines upon which it was built up, or along its constructive lines. Several illustrations follow:

$161 \times 6 = n$	$966 \div 6 = n$
6	
600	$6\overline{)966} = 600 + 360 + 6$
360	$100 + 60 + 1 = 161$
6	
966	
$93 \times 8 = n$	$744 \div 8 = n$
8	
720	$8\overline{)744} = 720 + 24$
24	$90 + 3$
744	

$1732 \div 4 = n$

$4\overline{)1732} = 1600 + 120 + 12$

$400 + 30 + 3 = 433$

The child may separate it thus:

$$4\overline{)1732} = 1600 + 100 + 32$$
$$400 + 25 + 8 = 433$$

By separating it in several ways, each of which brings the correct number of 4's in 1732, he will come to see that there is one way that follows the lines of construction, and that this particular method serves his purpose best. He learns in this to look for a multiple of the divisor in the first part of the dividend and to look intelligently, a point that is of vital importance in division, and does away with the "wild guessing" so familiar to teachers.

After much of this work, the child becomes independent in both short or long division, and sees clearly what he is doing. He sees that he is finding how many times a certain measure (the divisor) is contained in the unmeasured whole (the dividend), and he finds it by thinking of the dividend as a product. This method of separating the dividend into its parts is much more effective than the usual method of placing the remainder after each division as a small figure in front of the next digit, and reducing, as $\begin{array}{r} 4\overline{)7^{4}3^{1}2} \\ 1\ 8\ 3 \end{array}$, because the eye helps and the child sees that 732=400+320+12. The latter meaning is not clear in the other method. The concise method comes later, and the child divides without any devices, in the desired form, as $\begin{array}{r} 4\overline{)732} \\ 183 \end{array}$. He sees the 400, the 32 (or 320) and the 12, while in the quotient he sees 100, 80 and 3.

Long Division. We need this process when a problem in division becomes too complex to carry in the mind. The greater the power of registration of the mind, the less often we have recourse to long division. The mind should be led to solve problems by short division beyond the divisor 9 or 12; for example, 7525÷25, 6500÷13, 62500÷25, 950÷19, 72480÷24, 850÷170, 840÷21, 6946÷23.

A divisor consisting of tens and units is simpler when the units digit is small; for example, 91 is a simpler divisor than 38; 72 than 49 and so on. This should be considered carefully in approaching long division. While the units digit remains small, the quotient figure is determined largely from the tens digit, and the eye helps more in the process.

After the preceding work in short division the child is ready to look at the more difficult numbers along the lines of construction. He readily thinks of the parts of the dividend, and the parts in the divisor; that is, he realizes the units, tens, hundreds, etc., of each number, as follows:

$64 \times 21 = n$

21

$1200 = 20 \times 60$

$80 = 20 \times 4$

$60 = 1 \times 60$

$4 = 1 \times 4$

1344

$1344 \div 21 = n$

$60 + 4$

$20+1\overline{)1344} = 1200 + 140 + 4$

$1200 + 60 = (60 \times 20) + (60 \times 1)$

$80 + 4$

$80 + 4 = (4 \times 20) + (4 \times 1)$

Here he notes the corresponding parts in the division and the multiplication. Another illustration:

523×42

42

20000

800

120

1000

40

6

21966

$21966 \div 42 = n$

$500 + 20 + 3 = 523$

$40+2\overline{)20000+1000+800+120+46}$

$20000 + 1000 = (500 \times 40) + (500 \times 2)$

$800 + 120 + 46$

$800 + 40 = (20 \times 40) + (20 \times 2)$

$120 + 6$

$120 + 6 = (3 \times 40) + (3 \times 2)$

$57188 \div 58 = n$ (Note the units digit is large.)

986

$\times 58$

45000

4000

300

7200

640

48

57188

$900 + 80 + 6 = 986$

$50+8\overline{)45000+7200+4000+940+48}$

$45000 + 7200$

$4000 + 940 + 48$

$4000 + 640$

$300 + 48$

$300 + 48$

Here the child sees clearly that he must consider the units digit of the divisor, and sees it is an element to be reckoned with in finding each quotient figure.

Now we bring the process gradually to a more and more concise form, taking care, however, that the pupil understands the reason for the omission of each step.

(a) $57188 \div 58 = n$

$$
\begin{array}{r}
900+80+6 \\
50+8\overline{)57188} \\
45000 = 900\times 60 \\
\hline
12188 \\
7200 = 900\times 8 \\
\hline
4988 \\
4000 = 80\times 50 \\
\hline
988 \\
640 = 80\times 8 \\
\hline
348 \\
300 = 6\times 50 \\
\hline
48 \\
48 = 6\times 8 \\
\hline
\end{array}
$$

$900+80+6=986$

(b)
$$
\begin{array}{r}
58\overline{)57188} \\
52200 = 900\times 58 \\
\hline
4988 \\
4640 = 80\times 58 \\
\hline
348 \\
348 = 6\times 58 \\
\hline
\end{array}
$$

986

(c)
$$
\begin{array}{r}
58\overline{)57188} \\
52200 = 900\times 58 \\
\hline
4988 \\
4640 = 80\times 58 \\
\hline
348 \\
348 = 6\times 58 \\
\hline
\end{array}
$$

986

(d)
$$
\begin{array}{r}
58\overline{)57188} \\
522 \\
\hline
498 \\
464 \\
\hline
348 \\
348 \\
\hline
\end{array}
$$

This final form should be seen to mean just what the preceding one means, and the so-called "bringing down the next figure" should be understood to be subtraction of the product of the divisor and partial quotient from the dividend.

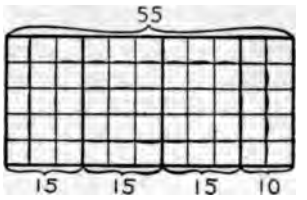
The next example illustrates the method followed when there is a larger divisor than those used above.

$403176 \div 428 = n$

$$
\begin{array}{r}
942 \\
428\overline{)403176} \\
385200 = 900\times 428 \\
\hline
17976 \\
17120 = 40\times 428 \\
\hline
856 \\
856 = 2\times 428 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
942 \\
428\overline{)403176} \\
3852 \\
\hline
1797 \\
1712 \\
\hline
856 \\
856 \\
\hline
\end{array}
$$

Meaning of Remainder. $15 \div 2 = n$. How many 2's in 15? There are 7 2's, or 14, and a remainder of 1, or there are $7\frac{1}{2}$ 2's in 15. $21 \div 6 = n$. We can take 3 6's out of 21 and have 3 left; that is, we find $3\frac{1}{2}$ 6's in 21.



The diagram shows concretely the dividend (55), divisor (15) and remainder (10).

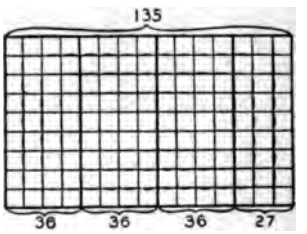
$7430 \div 18 = n$

$$
\begin{array}{r}
412 \\
18\overline{)7430} \\
72 \\
\hline
23 \\
18 \\
\hline
50 \\
36 \\
\hline
14
\end{array}
$$

We can take 412 18's out of 7430 and have 14 left. Note that the sum of the subtrahends and the remainder makes the dividend, as shown below:

$$
\begin{array}{r}
7200 = \text{first subtrahend} \\
180 = \text{second subtrahend} \\
36 = \text{third subtrahend} \\
14 = \text{remainder} \\
\hline
7430 = \text{dividend}
\end{array}
$$

The quotient is 412, with a remainder of 14, or the quotient is $412\frac{7}{9}$. This last says there are in 7430, 412 18's and $\frac{7}{9}$ of 18. If I had \$7430, I could buy at \$18 per acre 412 acres and have \$14 left, or I could buy $412\frac{7}{9}$ acres.



Showing in concrete form the remainder 27, resulting from dividing 135 by 36.

Some Short Methods of Division. (1) To divide by 10, 100, 1000, etc., by striking off one zero, two zeros, three zeros, etc. For example, 128ø, 6øø, 178øøø; or move the decimal point one, two, three, etc., places to the left. For example, 15.6, 8.432, .9678.

(2) To divide by 5, multiply by 2 and move the decimal point one place to the left. For example, $248 \div 5 = \frac{248\times 2}{10} = 49.6$.

(3) To divide by 25, multiply by 4 and move the decimal point two places to the left. For example, $3628 \div 25 = \frac{3628 \times 4}{100} = 145.12$.

(4) To divide by 50, multiply by 2 and move the decimal point two places to the left. For example, $784 \div 50 = \frac{784 \times 2}{100} = 15.68$.

(5) To divide by $33\frac{1}{3}$, multiply by 3 and move decimal point two places to the left, as: $800 \div 33\frac{1}{3} = \frac{800 \times 3}{100} = 24.00$.

(6) To divide by 125, multiply by 8 and move decimal point three places to the left, as: $1280 \div 125 = \frac{1280 \times 8}{1000} = 10.240$.

(7) To divide by 250, multiply by 4 and move decimal point three places to the left, as: $6845 \div 250 = \frac{6845 \times 4}{1000} = 27.380$.

(8) Divisor ending in zero. When the divisor ends in zeros the work may be shortened as shown below:

$7864 \div 60$	$96348 \div 800$
$6\|0\|786\|4$	$8\|00\|963\|48$
$131\frac{4}{60}$	$120\frac{348}{800}$

Proofs for Division. (1) For proof by "casting out 9's," see DIVISIBILITY OF NUMBERS, subhead *Casting out 9's*.

(2) Product of divisor and quotient plus remainder (if there is one) will equal dividend if problem is correct.

Partition and Division. See FRACTIONS.

Suggestions for Sources of Problems. From the following, home problems can easily be suggested, based on actual conditions:

(1) Yearly rent to find rent per month.

(2) Monthly or weekly salary to find average salary per day.

(3) Monthly expenses for food, for clothes, for amusement, etc., to find average expenditure per day.

(4) Amount of corn, wheat, etc., raised on a certain number of acres, to find average yield per acre.

(5) Expenses for fertilization, seed work, etc., on a certain number of acres, to find the average expense per acre.

(6) Cost of city lot of 35 feet, 50 feet, etc., to find price per front foot.

(7) Cost of a farm of 160 acres, 252 acres, etc., to find cost per acre.

Sources for Problems in Newspapers, Magazines, etc. (1) Exports of grain, lumber, etc., for a number of years, to find yearly average.

(2) Number of bushels in yield from given number of acres to find average, and from that to find gain or loss in average yield per acre, through the given years.

(3) Population and area of countries or states given to find the density of population; that is, to find the number of persons to each square mile.

(4) Wealth of a city or nation, and the population given to find the average wealth of the individual.

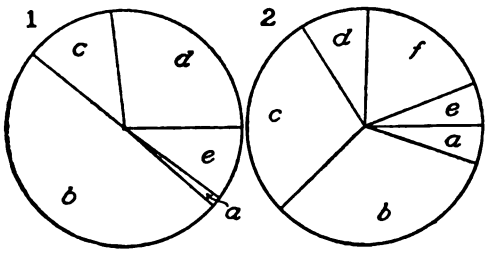
(5) The tax of a city given and the population known to find the average tax per individual.

The teacher or parent who learns to look for arithmetical problems in his every-day reading, will find much material of the kind indicated above. The child may be led to become awake to problems in his reading and may be encouraged to bring those real problems from the world about him into his school work and his home work in arithmetic. A.H.

DIVORCE, *di vohrs'*, in law, is the dissolution of the marriage relation. Marriage, being a legal relation between a man and a woman, and not a mere contract, can be dissolved only by lawful authority, as after the relation is once formed the law holds the parties to various obligations and duties. It originates in the consent of the parties, but after once entered upon can be terminated only by the death of the husband or wife, unless sooner ended by the courts under general laws. Jurisdiction in divorce cases in the United States is usually conferred on the law courts by the statutes of the different states. In England previous to 1858 divorces could be granted only by an act of Parliament, but in that year certain courts were vested with limited power to grant divorce.

Causes for Divorce. In society of the early day the husband was given the right to repudiate his wife at pleasure or for slight cause, but with the improvement of moral and religious codes the divorce laws have now become more stringent. Among the causes for which divorces are generally granted are unfaithfulness; cruelty; wilful desertion for periods varying from one to three years; habitual drunkenness; failure to support; imprisonment for felony; gross immorality, and incompatibility of temperament. Under the laws of the Roman Catholic Church divorce is never permitted, as marriage is regarded as a sacrament and its clergy will not perform the ceremony for divorced persons, except by special dispensation.

In a number of Protestant churches divorce is regarded as justifiable only when the case is considered extreme.



CAUSES OF DIVORCE IN THE UNITED STATES

For any ten-year period within fifty years the reasons for seeking divorce have changed but little. The above diagrams relate to the period between 1906 and 1916:

1. Granted to husband: (*a*) drunkenness, 1%; (*b*) desertion, 49%; (*c*) cruelty, 12%; (*d*) adultery, 28%; (*e*) all other causes, 10%.

2. Granted to wife: (*a*) drunkenness, 5%; (*b*) desertion, 33%; (*c*) cruelty, 29%; (*d*) adultery, 10%; (*e*) neglect to provide, 6%; (*f*) all other causes, 17%.

Laws Governing Divorce. Laws governing divorce are widely different in various states of the American Union, and difficult questions are constantly arising in regard to the validity in one state of divorces granted in another. South Carolina does not permit divorces. By a change in its law in 1914 Nevada requires an actual residence of one year within the state, instead of six months, before either party may apply for divorce. This step was taken to lessen the influx of Eastern mismated people who found the Nevada laws the most lenient of any in the nation. In some states two, three or five years must elapse before divorced parties can remarry, while in other states there is no restriction. The wife, when she is granted a divorce, is usually allowed a stipulated sum, called *alimony,* payable at regular times, until she remarries or until the husband dies.

Ratio of Divorce. In the United States statistics show that the ratio of divorce is increasing, more divorces being granted, in proportion to population, than in Europe, and, as a consequence, there is a growing movement for even stricter laws upon the subject. Some students of the problem favor a national divorce law, to be enacted by Congress, hence affecting equally all parts of the country; others prefer more uniform laws throughout the several states, believing the evil can be regulated better by the states than by the nation. There is also a very widespread belief that more stringent marriage laws would very greatly decrease divorce.

Canadian Divorce Courts. By the British North America Act the Canadian Parliament has sole power to deal with the subject of marriage and divorce, and it alone can grant divorce by special legislation on each case from the provinces of Ontario, Quebec, Alberta, Manitoba and Saskatchewan and the Northwest Territories. In the provinces of New Brunswick, Nova Scotia and Prince Edward Island courts have power to annul a marriage for such causes as are stipulated by law. The supreme court of British Columbia holds that it possesses all the jurisdiction conferred on the English divorce court. Divorces in Canada are rare, totaling fewer than 100 a year among more than 7,500,000 people; in Prince Edward Island no divorce was granted from 1868 to 1912. A.E.R.

Consult Thwing's *The Family;* Lichtenberger's *Divorce: A Study in Social Causation.*

DIX, JOHN ADAMS (1798-1879), an American statesman and soldier of wide reading and culture, especially famous for his services while Secretary of the Treasury in President Buchanan's Cabinet. He was born at Boscawen, N. H., saw service in the War of 1812 and remained in the army until 1826, when he resigned his commission as captain to study law. He was admitted to the bar in 1828 and filled many local and state offices, becoming Secretary of State in New York in 1833, and United States Senator in 1845.

While he was Secretary of the Treasury, government finances became more stable, and it was in that capacity that he issued his famous order, when a revenue cutter at New Orleans attempted to ignore his command to come to New York, "If any man attempts to haul down the American flag, shoot him on the spot."

At the beginning of the War of Secession he became brigadier-general and major-general of volunteers. In 1866 he was appointed minister to France, and in 1872 was elected governor of New York. Among other works he left several books relating to the city of New York.

DIX'IE, or **DIXIE-LAND,** a name popularly used to signify the Southern United States. The origin of the term is disputed. Some investigators claim it was derived from the Mason and Dixon's Line, which at one time roughly divided the free from the slave states. New York legends show that in the beginning of the nineteenth century it was the negro name for Manhattan Island, and signified to

them a paradise on earth; for it was there that a man named Dixie owned a large number of slaves whom he treated well and permitted to enjoy many of the pleasures of life denied the negroes in some other sections. When abolition sentiment grew strong and he was obliged to send some of his negroes South, they regretfully left their Northern home, and sighed for "Dixie's land."

Whatever may be the truth as to this legend, shivering Northern negroes saying, "I wish I was in Dixie's Land," inspired Daniel Emmett to write the famous and immensely popular *Dixie,* the song of the Southland.

DIXIE HIGHWAY, an automobile roadway which will ultimately stretch from the strait of Mackinac, at the northern end of the southern peninsula of Michigan, to Miami, near the southern end of the peninsula of Florida. It is distinguished from other new American highways by its purpose. Travelers by automobile gain intimate contact with a country and its people, whereas travelers by train get only a picture framed by car windows; it is hoped that the Dixie Highway will add to the friendliness between the people of the North and the South which comes from familiar intercourse, and which decades of ordinary business interchange and tourist travel could never intensify. At present the North has more automobiles and will use the road oftener, but the South is displaying as great an interest. Its people want their Northern neighbors to see the New South, the prosperous, growing, enthusiastic "Dixie" of the twentieth century. Counties and towns along the way are constructing the pavement, a great part of which is cement, and the women of Georgia have started a movement for planting trees and flowers by the roadside.

Originally the northern end of the Highway was fixed at Chicago, and though the route to Mackinac will probably be popular, that to Chicago will undoubtedly prove to be the main-traveled road. The two ways meet at Indianapolis. Between Chattanooga and Mackinac the traveler has his choice of two roads. The western, through Nashville, Louisville, Indianapolis, thence to Chicago or South Bend, Kalamazoo, and Grand Rapids and along the shore of Lake Michigan, is the true Dixie Highway. The eastern, by way of Knoxville, Lexington, Cincinnati, Dayton, Toledo, Detroit and the shore of Lake Huron, will appeal to those who like to go and come by different routes. It will be easy to cross from one to the other along the Lincoln Highway, the Pike's Peak Highway or any of the other east-to-west roads.

An Historic Setting. There are many places of historical interest along the Dixie Highway,

ROUTES OF THE DIXIE HIGHWAY

most of them in the South. Just east of the main road at Elizabethtown, Kentucky, is the little farm on which Abraham Lincoln was born, now a shrine of the nation. At Chattanooga and Chickamauga are the scenes of great

struggles in the War of Secession, including the "Battle above the Clouds" and Missionary Ridge. For part of the distance between Chattanooga and Atlanta the route followed is that of Sherman's march to the sea. In Florida there are landmarks of a far earlier date, especially at Saint Augustine, where stands Fort Marion, begun over three hundred fifty years ago and held at different times by the soldiers of Spain, Great Britain, the United States and the Confederate states.

Scenery. As a scenic route the road is charming. The wooded dunes of Michigan, the corn lands of Illinois and the low hills of Indiana contrast sharply with the country farther south. In Kentucky the way of the western branch is through the cave region, and Mammoth Cave is not far to one side; the eastern branch traverses the blue-grass country. Through Tennessee the hills rise higher and higher, till at Lookout Mountain the traveler is over two thousand feet above the sea and fifteen hundred feet above the river beneath. In Georgia the cotton country is reached, then the land of lumber, turpentine and tar. Near Florida the live oaks and palmettos give a hint of the semi-tropical nature of the rest of the road, and along the coral-built east coast, Florida's Riviera, with its famous resorts, Saint Augustine, Daytona, Palm Beach and Miami, are seen groves of oranges, grape fruit, lemons and guavas, fields of pineapples, and banana trees and cocoanut palms. From Miami it is a short trip, by train and boat or by boat alone, to Havana, and when the roads of that island are improved, many Dixie Highway travelers will no doubt extend their journey into the tropic island.

History. The Dixie Highway was the idea of Mr. Carl G. Fisher of Indianapolis, who was also the founder of the Lincoln Highway movement. Governor Ralston of Indiana called a conference of the governors of all the states interested—Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, Georgia and Florida—in 1915, and each governor appointed two commissioners, who made selections of roads and secured the coöperation of local authorities. At the outset much of the route was over roads of the worst type, but over five million dollars were spent in improvements the first year. There were said to be over half a million automobile owners in the territory served by the highway, including its branches, when active construction began; this number is now much greater. See LINCOLN HIGHWAY. C.H.H.

DIXON, THOMAS, JR. (1864-), an American novelist and playwright, who at one time was a preacher and lecturer. His works, strong and vital in parts, deal chiefly with the South and its negroes; they show vivid pictorial description and are in bold defiance of criticism. He was born in Shelby, N. C., was graduated from the Greensboro law school and admitted to the bar. In 1885 and 1886 he was a member of the North Carolina legislature, but resigned to enter the ministry, where he gained a reputation for freedom and originality of thought and powerful expression. He has also been a popular lecturer.

Among his writings are *The Leopard's Spots*, frankly dealing with the negro question; *The One Woman*, a story dealing with the divorce problem; *The Clansman*, picturing conditions in part of the South under the domination of the negroes and carpetbaggers during the Reconstruction period; *The Sins of the Fathers*, a gripping human-interest story which was dramatized and in which Dixon played the leading part; *The Southerner*, *The Victim*, *A Romance of the Real Jefferson Davis* and *The Foolish Virgin*.

The Leopard's Spots and *The Clansman* have also been dramatized, a very wonderful and stirring moving picture production having been adapted from the latter by D. W. Griffith, under the title *The Birth of a Nation*. After the latter task was accomplished Dixon wrote *The Fall of a Nation*, a story which owed its inspiration to the War of the Nations in Europe, then in progress (1915).

DNIEPER, *ne'pur*, the second largest river of Russia, rising in the government of Smolensk and after a winding course of 1,300 miles emptying its waters into the Black Sea through a mouth ten miles in breadth. Because of the benefits it brings to a large area it is held in great veneration by the Russian peasants, who call it *Father Dnieper*. It is navigable for almost its entire length, the rapids which formerly impeded the passage of ships having been remedied by blasting. As a commercial route the Dnieper is of the greatest value to Russia. Grain and lumber to the value of over $50,000,000 are annually borne on its waters to the Black Sea; the river flows through the heart of Russia's great "Black Belt," one of the world's most important wheat-growing districts. It abounds in fish, which are exported in great quantities. The Beresina, Pripet, Psiol, and Desna rivers are its most important tributaries. The Dnieper flows

through highly cultivated agricultural districts and waters an area of 203,462 square miles.

DNIESTER, *nee'stur,* a river rising in the Austrian province of Galicia, flowing from the slopes of the Carpathian Mountains and emptying its waters into the Black Sea after a southeasterly course of 850 miles. More than 500 miles of its length is in Russian territory, and during recent years the imperial government has done much to increase commerce by dredging and blasting the river bed. It is now navigable from the Black Sea to Khotin, on the Russian frontier, and its boats carry great quantities of fish, lumber and grain to the sea. It flows through the western end of the great Russian wheat belt, one of the world's most productive grain centers.

DOCK, a large herblike plant of the buckwheat family, very troublesome as a weed throughout the United States. The roots of three species, however, the yellow, the broad-leaved and the yellow-rooted water dock, are used in tonics, as astringents, and especially for skin diseases. About 125,000 pounds of dock roots are imported into the United States each year, the price ranging from two to eight cents per pound.

The docks grow from two to four feet high and have long, large leaves, usually lance-shaped or heart-shaped, sometimes with very heavy margins. The flowers are small, greenish and inconspicuous.

DOCK. To say, "He fell off a dock" is no more correct than to say, "He fell off a hole," according to authorities on the usage of words. Yet to most people in America a dock is a

AT DETROIT, MICHIGAN
A type of the ordinary dry-dock.

wharf, a structure alongside of which boats may be fastened. This local perversion of the word probably arose from the circumstance that in America there are almost no true docks

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—enclosures in which ships may be anchored while in port, the dock being the basin containing the water which floats the ship. In Europe such docks are well known. They are most valuable at shipping points where the tide rises and falls many feet. At Liverpool, for instance, the River Mersey is lined for miles with enclosures whose gates may be closed to retain water for ships when the tide goes out.

Dry-Docks. When a dock is built so that the water in it can be pumped out, it is called a dry-dock. Ships needing repairs beneath their water-lines may be towed into it and braced in position before the water is withdrawn. *Floating dry-docks* are steel shells which can be raised or lowered, like a submarine, by pumping water out or in. One may be made to sink until its floor is low enough to permit a ship to enter, and then raised until the ship's keel is out of water. Probably the most famous floating dry-dock is the *Dewey,* which was constructed in 1905 and successfully towed from Maryland to the Philippine Islands.

DOCKYARDS, government establishments in which warships are built, repaired and fitted out with all required stores. There are eight of these establishments, officially called *navy yards,* in the United States. Two are on the Pacific coast, at Puget Sound, Wash., and Mare Island near San Francisco, Cal. The other six are on the Atlantic coast, at Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., Washington, D. C., Norfolk, Va., and Philadelphia, Pa. The principal British dockyards are at Portsmouth, Devonport, Sheerness, Chatham, Queenstown and Pembroke. Canada has well-equipped dockyards at Halifax, Nova Scotia, and Esquimalt, B. C., for the convenience of warships of Great Britain.

DODDER, *dod'er,* a twinelike parasite plant, native of Europe, but found in June and July in the United States south and west from New York as far as the Rocky Mountains. It starts from the ground, living on the starch stored in the seed. Then its pale-yellow, fine, leafless stems twine on other plants and hold on by means of rootlets or suckers. It then breaks loose from the soil and feeds on the plant to which it is attached. These thread-like stems form a tangled mass and later produce dense clusters of small white flowers.

Dodder is very destructive, especially to flax, clover and alfalfa. The best prevention is careful examination of seed before planting. Dodder seed is a little smaller than clover seed and can be screened out if sufficient care

is used. The best cure is burning the infested places before the dodder seed matures. See illustration in article BOTANY, page 859; also FUNGI; PARASITES.

DODGSON, *doj'son,* CHARLES LUTWIDGE (1832-1898), an English writer who is known to countless readers by his pen name of LEWIS CARROLL, which appears on the title pages of two of the most charming and original stories for children ever written—*Alice's Adventures in Wonderland* and *Through the Looking Glass.* He was accustomed to use his real name when he published his various learned books on mathematics, for he was a mathematical lecturer at Christ Church, Oxford University, from 1855 to 1881.

During his lectureship at Christ Church he became the well-beloved companion of the three little daughters of the college dean, Lorina, Alice and Edith Liddell, and the *Wonderland* adventures of Alice are the stories he told the children on some of their afternoon boating excursions on a pretty little river of the town.

As examples of delightful nonsense, the *Alice* books are in a class by themselves, and their charm has been increased by the pictures drawn for them by one of England's greatest cartoonists, Sir John Tenniel. His portraits of the Cheshire Cat, the Mad Hatter, Tweedledum and Tweedledee and all the other picturesque companions of Alice in her wanderings in the land of adventure are an inseparable part of the narratives themselves. Dodgson wrote several other stories for children, among which are *The Hunting of the Snark, Rhyme and Reason* and *Sylvie and Bruno.* See ALICE'S ADVENTURES IN WONDERLAND.

DODO, *doh'doh,* a bird no longer in existence, but once related to the pigeons. It is known only from descriptions of Portuguese and Dutch voyagers and from specimens in the British Museum. The dodo was a clumsy

SKELETON OF THE DODO
Dotted lines represent the form of the bird.

bird, larger than the swan, covered with grayish down, and with a tail appearing like a tuft of curled feathers. It walked very slowly on short, ill-shaped legs, and as its wings were too short for flight, it was easily captured. Its appearance and actions gave it the name, which means *simpleton.* The dodo was at one time abundant on the islands of Mauritius and Bourbon, but as it was valued as food by visitors and was also captured by hogs the sailors turned loose, the genus became extinct.

DOG, a faithful, courageous and intelligent domestic animal, to which no truer or more simple tribute could be made than the following eulogy by Former Senator George Graham Vest:

The one absolutely unselfish friend that man can have in this selfish world, the one that never deserts him, the one that never proves ungrateful or treacherous, is his dog. A man's dog stands by him in prosperity and in poverty, in health and in sickness. He will sleep on the cold ground, where the wintry winds blow and the snow drives fiercely, if only he may be near his master's side. He will kiss the hand that has no food to offer, he will lick the wounds and sores that come in encounter with the roughness of the world. He guards the sleep of his pauper master as if he were a prince. When all other friends desert, he remains. When riches take wings and reputation falls to pieces, he is as constant in his love as the sun in its journey through the heavens. If fortune drives the master forth an outcast in the

world, friendless and homeless, the faithful dog asks no higher privilege than that of accompanying him to guard against danger, to fight against his enemies. And, when the last scene of all comes, and death takes the master in its embrace, and his body is laid away in the cold ground, no matter if all other friends pursue their way, there by his graveside will the noble dog be found, his head between his paws, his eyes sad but open in alert watchfulness, faithful and true even to death.

Origin. The earliest date of domestication of the dog is a matter of dispute, but he was the companion of man before history was first recorded. There is no doubt, however, that dogs are the descendants of several different kinds of wolves and jackals. Various breeds of dogs are now found everywhere, except perhaps in New Zealand. They serve the cannibals of the Pacific islands, the Eskimos of the frozen north, the red men of the prairies and the white men of all civilized cities of the world. A few of the habits of their wild ancestors of the jungles and plain are still retained by the dogs of the household, such as digging up the earth with their forefeet and throwing it back with the hind feet, and turning around two or three times before lying down. If left to themselves some kinds of dogs would no doubt again become wild, as did the dogs left on Robinson Crusoe's island and as did the noble beast in Jack London's *Call of the Wild*. They would lose their bark, which observers consider an attempt to imitate the human voice, and would merely yelp and howl. Wild dogs are found in Southern Asia and in the islands of the Pacific. In Australia one species, a destroyer of sheep, is known as the *dingo*. The wild dog of India is the *dhole*, about which Kipling has written.

Breeds and Characteristics. There are about two hundred breeds of domestic dogs, which vary greatly in size, appearance and structure. All, like the cat, have five toes on the forefeet and four on the hind feet, but the claws are duller, shorter and not retractile, that is, cannot be drawn back into the toes. All earn their keep for some special service to the master, ranging from mere companionship, affection and devotion to the protection of life and property. All the important breeds of dogs are described in separate articles in these volumes, and a list of these will be found under the heading *Related Subjects* at the end of this article.

Dogs That Work. In snow- and ice-bound northern lands dogs play an important part in the activities of man. In Alaska, sled dogs and reindeers are employed almost entirely for transportation. Dogs which are half wolf, called *malamutes*, are harnessed to sleds in a line, one before the other. Those dogs are thievish and are fierce fighters, however, and the Labrador *huskies*, a longer-legged, more efficient cross-bred dog, is taking the place of the malamutes. These "huskies" are harnessed abreast so they spread out in a fan-shaped team. Usually seven or nine dogs make such a team, and the burden for each is about 150 pounds. Many dogs are in the employ of the United States government in Alaska, carrying mail.

One of the interesting sights in Belgium is the little shop and vegetable market on wheels. Here and there on city corners, on a pleasant day, dog-drawn carts are seen, filled with wares to be sold to the passer-by (see page 665). In other European countries dogs earn their living in many unusual ways. As members of the armies, the dogs of war are trained as sentries, messengers, scouts and ambulance dogs. They search the battlefield for the wounded and missing, and in this work are invaluable, for they do not need light and can do the work by night, merely by scent. These animal Red Cross helpers bear flasks of brandy or soup and a roll of bandages about their necks for the relief of wounded men. By following the tinkle of bells on the dog's neck, stretcher bearers know where to go, and a low whine from the dog announces that a man has been found.

Hounds are employed in police departments of many large European cities, where they aid in capturing criminals. The use of various kinds of dogs as hunters of game is well known everywhere. The collie is a famous shepherd dog, and is described under its title. Stories about the rescuing of lost travelers in the Alps by the great Saint Bernards, and the saving of the drowning by those strong swimmers, the Newfoundlands, are numerous, interesting and true. It is said that one Saint Bernard called "Old Barry" rescued forty-two men in the Alps—truly a medal-deserving hero.

Dogs, too, have served in the cause of humanity. An English dog, called "Help," traveled

on railway trains for three years, bearing an inscription on his collar, "I am Help, the railway dog of England, and traveling agent for orphans of railway men who are killed on duty." Within those three years he collected more than $2,500, never failing to bring his collar-bank safely to his masters.

Training and Care. Not only can various breeds of dogs be trained to hunt, but even the mongrel pet of the household has intelligence keen enough to be taught various tricks —to beg, to "speak," to fetch, carry and do various simple acrobatic feats. A sharp reproof will be more effective than blows, and a kindly word will bring forgetfulness of former harshness and will call forth that sign of devotion, a grateful wag of the tail.

Cleanliness and freedom from draughts are as necessary to the dog as to man; these will guard against the disease known as distemper (which see). To remove fleas, that burden of a dog's life, careful bathing is necessary. Under favorable circumstances a dog will live four fifteen years. Even with the best of care, however, it is liable to disease. The worst of these is rabies, or hydrophobia (see HYDROPHOBIA). If a human being is bitten by an animal suffering with rabies, the disease will be imparted to the person bitten.

A dog can go longer without meat than without water, so his special water-pan should always be kept filled. One meal a day for a grown dog is considered sufficient; that may be of dog biscuit or the coarse scraps from the table, with not too much meat. A dog, to look best and to show most intelligence, should be neither fat nor lean, but just sleek. The occasional bone should not be forgotten, for gnawing on a bone keeps the dog's teeth sharp, and forms part of its amusement, too. Who has not watched a dog carefully bury its bone and then later seen another unearth it?

Outlines for Essays on the Dog

The Dogs I Pass on My Way to School

(1) The distance I walk
(2) The number of dogs I pass
(3) The "next-door" dog
  (a) His appearance
  (b) How he shows his pleasure at sight of me
(4) The biggest dog I see
  (a) Where he lives
  (b) His appearance and name
  (c) How he greets me
(5) The smallest dog I see
  (a) How he watches for me at the window
  (b) His shrill bark
  (c) His courage
(6) The dog that follows me to school
  (a) How he shows his liking for me
  (b) Why I like him best

A Conversation Between a Poodle and a Saint Bernard

(1) The poodle speaks
  (a) Pride in my appearance
  (b) The many things I cannot do
  (c) My contempt for "rough" dogs
  (d What I like best
    1. My warm corner
    2. My soft cushion
    3. My dainty food
    4. The ride with my mistress
(2) The Saint Bernard speaks
  (a) My birthplace in the Alps
  (b) My home in the hospice of Saint Bernard
  (c) The great snowstorms
  (d) How I was fitted out for my rescue work
  (e) The hunt through the blinding snow
  (f) The joy at finding a traveler
  (g) My pride in my strength

Dog Laws. In nearly all large cities there are laws specifying the terms on which dogs may be kept and allowed to run at large, and most of them impose a license, or tax, on dogs. A dog may be killed in self-defense, or after notice to the owner that he is a menace to the community. Societies for the prevention of cruelty to animals have been organized in most countries, and in many places they have erected homes for stray dogs. V.L.K.

Dog Books. In addition to Jack London's *Call of the Wild,* Oliphant's *Bob, Son of Battle* must be mentioned as one of the best dog stories in print. Brown's *Rab and His Friends,* Richard Harding Davis' *The Bar Sinister* and Ouida's *A Dog of Flanders* are classics among short stories. There are many dog fables and poems. Among the latter two well-known ones are Goldsmith's *Elegy on the Death of a Mad Dog* and Trowbridge's *The Vagabond.* In *Oliver Twist* is the story of Bill Sikes and his dog. See, also, Hodge's *Nature Study and Life, The Dog in History and Folklore* in *Sketches and Studies* by R. J. King, and Watson's *Dog-Book.*

Related Subjects. The following breeds of dogs are given separate treatment in these volumes:

Bloodhound	Pointer
Bulldog	Poodle
Collie	Pug
Dachshund	Retriever
Dingo	Saint Bernard
Eskimo Dog	Scotch Terrier
Foxhound	Setter
Fox Terrier	Shepherd Dog
Great Dane	Skye Terrier
Greyhound	Spaniel
Hound	Spitz
Mastiff	Staghound
Newfoundland	Terrier

DOG'BANE, a milky-juiced American shrub growing near meadow borders from Canada to Carolina. The spreading dogbane, or *honey-bloom,* has light green leaves and clusters of pale pink bell-shaped flowers. Its root is very bitter and is used in place of ipecac to cause vomiting. The other species, known as *Canada* or *Indian hemp,* has paler flowers, crowded together, and its bark yields a long and strong white fiber, which is used for making nets. Dogbane was at one time believed to be poisonous, but it may be eaten without harm by cattle in pastures or prairies.

DOG DAYS, a period in summer usually characterized by being the hottest days of the year. The name was first applied by the ancients to the time of the rising of the dog star Sirius; it covered a period of about forty days in the hottest season of the year. That star now rises at a different time, but the hot, sultry summer days are still called the *dog days.* As dogs usually suffer in hot weather and sometimes go mad and cause injury by the bites they inflict, in large cities laws require that they be muzzled. So, from that fact it has often been incorrectly believed the term originated. It is interesting to note that dogs contract the disease which makes them "mad" more frequently in cold than in hot weather.

DOGE, *doje.* As in the United States the President rules the nation as the Chief Executive, so in the republics of Venice, Amalfi and

sebec, and served as captain of battalion during the Riel Re- 5. He was appointed professor nternational law at McGill Uni- 0, and retained this position for nty years. He was elected as to the Dominion House of and in 1911 was made Min- e Borden Cabinet.

the ocean near the equa- re alternating calms, winds make it diffi- ilors fear and avoid sible, calling them ss. They seem to h in January, hav- trade winds, hanging until the publication the ocean that vessels to steer away from the e ocean in these parts.

sons, to be *in the doldrums* on of listlessness.

f winds under varying names, see D, in Volume VIII.

l, NATHAN HASKELL (1852-), author who has won distinction translator and writer of both try. After his graduation from ge in 1874 he taught for several 1881 became musical and literary Philadelphia *Press*. Later he ry adviser of publishing houses . Dole's original works include *posers; The Hawthorne Tree, ems; Joseph Jefferson at Home; of Count Tolstoi*, and *The Spell l*. Among his translations are *Karenina*, Daudet's *Tartarin on* ga's *Cavalleria Rusticana, Mem- ess von Suttner*, and hundreds various languages. He has also collections of prose and verse, toi's works and a comprehensive *Rubaiyat of Omar Khayyam*.

FORD BALLARD (1844-), an sman who has held many promi- the former republic and present awaii. He was born at Honolulu, parentage, and was educated at ege (Mass.). He was admitted Boston; returning to Hawaii, he ge of the Supreme Court in 1887. olution of 1893 which deposed became President of the pro- ment and in the following year was chosen President of the republic of Hawaii. Largely through his influence as a strong advocate of the annexation of Hawaii to the United States, the islands were converted into a territory, and he became its governor in 1900. Resigning in 1903, he was appointed United States district judge of the territory. See HAWAII.

DOL'LAR. In the United States and Canada the silver or gold coin whose value is 100 cents is called a dollar. In 1792 the Coinage Act was passed which established the dollar as the basis of the American monetary system. This was copied after the Spanish dollar then in circulation among the colonies, but the name is derived from the Dutch *daler* or German *thaler*. The first United States silver dollars were made in 1794 and continued to be coined until 1905. These are still largely circulated in the western part of the country, but people in the East object to their weight, and demand paper dollars, whose value is guaranteed. By an Act passed on March 14, 1900, the gold dollar, weighing 25.8 grains, nine-tenths pure gold, was made the standard dollar in the United States, but no provision was made for coining it. See MONEY; COINAGE.

DOLLS, PAPER. Happy is the little girl who has a pair of scissors, a few pieces of colored papers and ten nimble fingers, for with these tools and materials she can spend many delightful hours. She need not depend upon the sets of paper dolls sold in the toy shops, for out of plain white paper she can cut her own dolls, and out of colored papers she can plan and make most interesting costumes.

Fig. 1 shows a 4½" x 6" piece of cream-colored paper, folded in the middle. (The symbol (") stands for *inches*.) It will be best to practice on bits of folded newspaper until you can cut the half-shape of a doll to look like Fig. 2. The doll shape, when unfolded, should look like Fig. 3. With a lead pencil, draw carefully the eyes, nose and mouth, copying from Fig. 3. The shape of the hair can be cut from light or dark brown paper (Fig. 4) and pasted in place. Dolly is now ready to be dressed.

From your sheets of colored paper, choose the material for a dress. Shall it be blue, brown or white? Fig. 5 shows a piece of blue paper cut 3"x6½". It is folded in the middle, as both sides of this first little dress are to be alike. Fig. 6 shows the shape of the neck cut out from the folded edge and one of the folded corners snipped off. Fig. 7 shows the little dress completed.

DOGFISH

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PAPER DOLLS

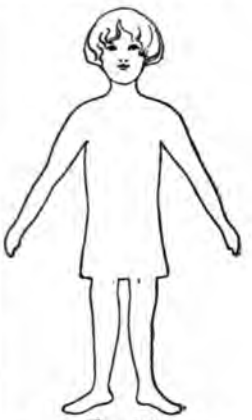


Fig. 14
A Boy Doll Cut from Paper

Fig. 15

Fig. 17

Fig. 16

Fig. 18

Fig. 19

Fig. 20

Fig. 21
Scotch

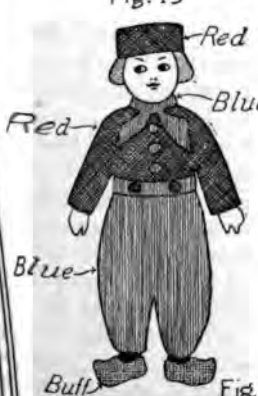


Fig. 22
Dutch

Fig. 23
Chinese

Fig. 24
Spanish

Now comes the pretty part. The little dress can be trimmed in a number of ways. In Fig. 8 a white collar has been cut from paper and pasted in place. White strips of paper have been cut for bands, and pasted to the bottom of the dress and sleeves. Charming little shoe shapes were cut from black paper, and sock shapes from white paper. These shapes were pasted over the feet and legs of the doll. Dolly can change her dress, but she must always wear the same shoes and socks. A ribbon hair-bow and necktie add the finishing touches to this charming costume.

Five more ways of cutting and of trimming dresses for paper dolls are shown in Figs. 9, 10, 11, 12 and 13.

No paper doll family is complete without some boys. Their costumes are of more sober colors than the costumes of girls, but the styles and shapes are interesting to cut. A sailor costume for a boy can be cut from dark blue and white papers.

Fig. 14 shows a boy doll cut from cream-colored paper. The process of cutting out this shape is the same as is shown in Figs. 1, 2 and 3. Figs. 15 and 16 show the blouse and trousers cut from dark blue paper. A white collar and a black tie, both cut from paper, have been added to Fig. 15. The cap is shown in Fig. 17. The Sailor Boy cannot change his costume, because the clothes must be pasted to the figure. It would be interesting to cut a number of boy dolls and dress them in different costumes. Figs. 18, 19 and 20 show three different costumes that can be cut and pasted on three different boy dolls.

Paper dolls may be dressed in the costumes of other nations. Is it not strange that we can represent, by means of cut papers, shoes, hats, caps, dresses, parasols, sashes, neckties and everything that is worn? If the shapes are true and the colors harmonious, these costumes will be as beautiful as painted designs.

Fig. 21 shows a boy doll dressed in a Scotch costume. The kilt skirt and the sash are cut from plaid paper. You can make your own plaid by drawing lines, carefully spaced, on green, gray or blue paper, with colored crayons. Use a ruler, and see that the points of the crayons are sharp. Cover a sheet of 6″ x 9″ paper with the plaid design, and then cut from the sheet the shapes of kilt and sash, and the band for the cap. The stockings could be cut from gray paper, with dark red lines drawn afterward upon the shapes, to look like "cross gartering."

The Dutch Boy (Fig. 22) is easy to dress. His wide trousers, his quaint cap and his wooden shoes can all be cut from the colors that are printed on the drawing. All of these shapes should be cut from folded papers, so both sides of the shapes will be exactly alike.

The little Chinese lady, with her kimona and parasol, makes a most attractive doll. Her black hair can be cut from black paper, her kimona from violet tissue that looks like silk, and her parasol from green paper, with small pieces of red paper used for a decorative pattern.

Fig. 24 shows a Spanish boy, arrayed in the splendor of black velvet and gorgeous color. Cut the trousers and coat from folded paper, as these shapes are to be alike on both sides. The sash and the ribbon bow on the cap must be cut from single thickness of paper, as they are irregular in shape. After you have made these paper doll costumes from the sketches, you should invent some costumes of your own or work some paper costumes in colors, from pictures that you find in other books. B.S.

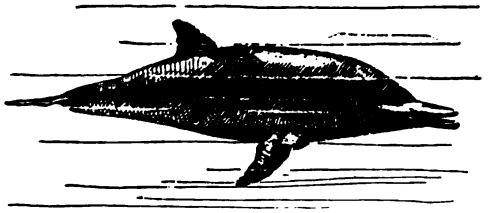
DOL'OMITE, a rock composed of limestone and a compound of magnesium and carbonic acid. It is sometimes called *magnesium limestone*. The purest varieties, when crystallised, are known as *pearl spar;* this has crystals with curved surfaces and is of a pearly luster. Dolomite varies in color from yellowish-white to yellowish-brown and gray. It occurs in large masses in Europe, where great mountains in Switzerland, Austria, Italy and England are formed almost wholly of dolomite. In the United States it is found in the New England States, Eastern New York, Georgia and Tennessee. Some of the finest statuary marble is dolomite. Another variety, called *bitter spar* or *rhomb spar,* is gray, yellow or reddish-brown, and is partially transparent. Dolomite is a good building stone, but the common variety does not take a polish. See LIMESTONE; MARBLE.

The Dolomites, a section of the Alps on the border between the Austrian Tyrol and the Italian province of Venice. Composed of the comparatively soft mineral known as dolomite, these mountains have been carved by the winds and rains and frosts into every sort of fantastic shape. John L. Stoddard has called them "the Alps in ruins" and compared their appearance to "castles, citadels, cathedrals, obelisks, towers, pyramids, chimneys, needles, bayonets, tusks, and other grotesque and distorted shapes, to name which all the languages

devised by man are insufficient." The tallest of the peaks is Monte Marmolata, whose summit rises 10,972 feet above the sea. On the southern slope of the mountains lie Pieve di Cadore and Cortina d'Ampezzo, both of which claim to be the birthplace of Titian, and both of which figured in the War of the Nations. For eight centuries before Napoleon there was a republic of Cadore, which was allied to Venice, and in the days of the Little Corporal's greatness the masts for its ships and the piles which supported the city were larches and pines from the Dolomites.

DOLPHIN, *dol'fin.* In all tropical and temperate waters of mid-ocean the traveler on shipboard often sees flashes of brilliant green, which shoot along rapidly, turning hither and thither. "Dolphins!" someone cries, and eyes are strained to catch a glimpse of those beautiful olive-green marine animals. The lower part of the body is golden, but the smaller dolphin, which does not grow over two and one-half feet long, is sea-green, with a silver covering on the lower part of its body. The large dolphin, which reaches a length of about six feet, is liked by sailors as food.

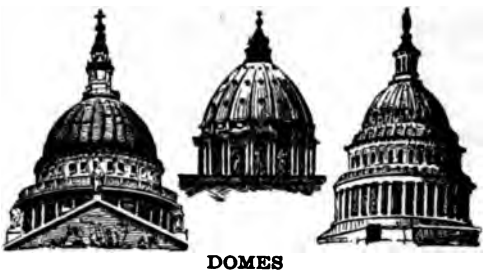
These strong, rapid swimmers, traveling in schools, gather around a ship and delight the passengers with their graceful motions. Up they dart, many feet into the air, and back



Ere the dolphin dies
Its hues are brightest. Like an infant's breath
Are tropic winds before the voice of death.
—*Fitz-Greene Halleck.*

again into a wave, shooting so quickly that they leave a narrow white streak behind them in the water. They seem like mermaids of the sea as they play in the water, and many old legends about them were written by the Greeks. The dolphin was sacred to Apollo and was put on many ancient coins and medals. When dying, the dolphins change their color to many brilliant shades, which poets have often celebrated.

DOME, *dohm,* in architecture, a hemispherical or angled roof, shaped like an inverted bowl. The word is derived from the Latin *domus,* meaning a *house,* or *home.* A dome may be constructed of various materials, such as stone, brick, wood or earthenware. This form of roof is of ancient origin, having been first used in the Byzantine Empire. At that time there was no way known by which a round roof could be placed on any other than a round building. That difficulty, however,



DOMES

At left, Saint Paul's, London; center, Saint Peter's, Rome; right, the Capitol, Washington, D. C.

was overcome, and the Church of Saint Sophia in Constantinople was the first rectangular building to be capped by a dome (see page 325). This was done by means of pendentives (which see), and that style of architecture immediately became popular.

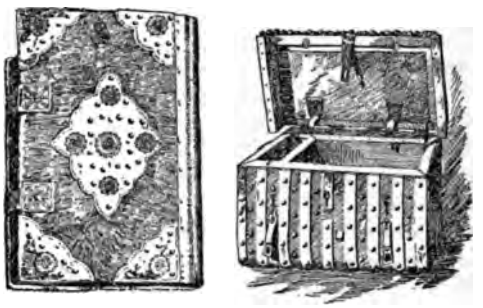
The dome was the usual style of roofing for Arabian tombs and mosques. It was copied in India, where it was soon recognized as a distinctive style of Mohammedan architecture. One of the most beautiful domes in the world surmounts the Taj Mahal (which see) at Agra, and one of the largest is the roof of the tomb of Mahmud at Bijapur. The most noteworthy domes are those on Saint Peter's, Rome; Saint Paul's Cathedral, London; the Hotel des Invalides, Paris; the Capitol at Washington, and the capitol, Madison, Wisconsin. Far surpassing all others in existence, ancient and modern, is the famous dome of the Pantheon at Rome, 140 feet in diameter and 143 feet high. The largest dome ever constructed, however, was a temporary one, on the Palace of Horticulture at the Panama-Pacific Exposition at San Francisco in 1915. It was 152 feet in diameter and 185 feet high, and its huge steel frame was roofed over with glass. It was torn down at the close of the exposition.

DOMENICHINO, *do may ne ke'no,* (1581-1641), an Italian painter, one of the most eminent pupils of the Carracci, who established at Bologna, in about 1580, the first modern academy of art. His earliest notable work was done in Rome, where he painted his masterpiece, *Last Communion of Saint Jerome.*

This canvas now occupies a place in the Vatican, opposite Raphael's *Transfiguration*. While in Rome he also produced several fresco paintings of religious and mythological subjects. Between 1617 and 1621 he lived in Bologna, the most important production of this period being his *Madonna of the Rosary*.

In 1621 Pope Gregory XV recalled him to Rome to become chief painter and architect of the Papal palace, and ten years later he was commissioned to decorate with frescoes a chapel of the cathedral at Naples. The best works painted during his second visit to Rome are the *Four Evangelists* and a charming mythological picture, *Diana and Her Nymphs Bathing*. Domenichino excelled in landscape and fresco painting, using landscape effectively as a background, and he has been highly praised for the naturalness of his scenery and for the lifelikeness of his human figures.

DOMES'DAY BOOK, or **DOOMS'DAY BOOK,** one of the most interesting historical volumes in existence. When William of Normandy conquered England in 1066, he rewarded his followers by giving them land



DOMESDAY BOOK AND CHEST

There are two large volumes of the survey, one being a folio of 760 pages, the other a larger octavo of 900 pages. The strong box shown in the illustration is the chest in which the volumes were once kept.

The picture above is from a drawing made from a *facsimile* edition published by command of Queen Victoria in 1862.

which had previously belonged to the conquered people. Wishing to know how the country was peopled, how much land belonged to the king himself, and how the rest of the land was partitioned, he caused a survey to be made. Each landowner or holder was requested to give to the king's commissioners full particulars concerning the land he owned or held and of property of every kind he possessed.

The country was divided into districts, each district furnishing as census-takers, so to speak, a certain number of men familiar with the disposition of land and property, to assist the king's commissioners. The result was a complete return of all details concerning land and property in that part of England controlled by William. His authority did not extend far enough north to include Northumberland, Cumberland, Durham or Westmoreland. All information gathered, in some instances even to the number of sheep and swine, was published in the Domesday Book, against the record of which there was no possibility of appeal. There are many families in England who find cause for pride in the fact that their family name appears in the Domesday Book among those of landowners. Perfect facsimiles of the original Domesday Book were published in 1861 and 1865. See WILLIAM I, THE CONQUEROR.

DOMESTIC, *do mes' tik,* **ART.** Grandmother has told you many stories about the good old days when she was a little girl.

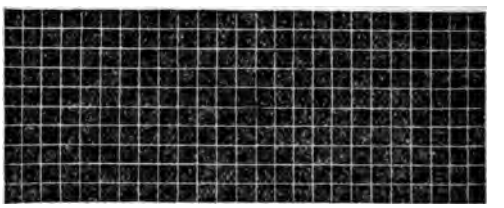


Fig. 1

Grandmother's mother was a fine, old-fashioned woman, who thought that little girls should be taught to cook, to sew, to knit, and to do everything that is necessary to be done about a house. The schools where Grandmother and her little friends learned to "read, write and cipher" had no classes in sewing or cooking, for mothers were expected to teach these subjects to their daughters at home.

You have heard of the long seams that had to be sewed, of the patch-work blocks that had to be finished before the little girl whose name is now Grandmother could go out to play. Perhaps, when you listened to these stories, you felt sorry for the children of long ago, whose mothers insisted that lessons in sewing and knitting and other forms of hand

Fig. 2

work must be learned and learned well. But people have grown to think that such training is most important, and that it can be made very interesting.

It is not necessary, nowadays, for little girls to sew long seams by hand, for the sewing machine does that work better and more quickly; but every girl should know how to sew, how to crochet, how to knit, how to make

Fig. 3

tatting and how to use a number of decorative stitches in embroidery. These arts, which are just as truly arts as painting or drawing, are called *domestic,* because they find their chief uses in our domiciles, or homes. When you hear someone say that a girl is domestic in her tastes, it means that she is fond of her home and of everything that concerns it. Every girl should know a great deal about *domestic art.*

In other countries, such as Sweden, Italy, Germany and Russia, the domestic arts are practiced more than they are in America. The needlework that comes to us from each of these countries has a distinct character and

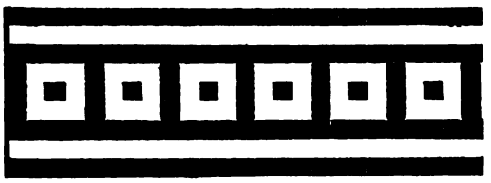


Fig. 4

interest. Swedish weaving, Italian embroideries, Spanish laces and Porto Rican drawnwork are all beautiful examples of the domestic arts of other countries. They are as different from each other as the people themselves are different, and so each country con-

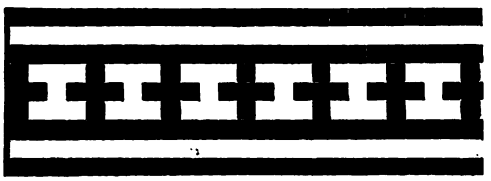


Fig. 5

tributes something to the beautiful work of the world that is distinctly its own.

In America we have not as yet discovered or developed domestic arts that are original. In our crochet-work, for instance, we depend on designs and patterns that have been invented by people in France and Germany, or in other countries. Why cannot the girls of America make their own designs? If they were taught to do so, and if the domestic arts were encouraged, we should surely be able to develop styles that are good, and not copied from other nations.

The girl whose mind and fingers are trained in the various fields of the domestic arts can do much to beautify her home, no matter how humble it may be. By the use of fine needlework, and with her ability to crochet, make tatting, smocking or embroidery, she can add distinction to the most inexpensive

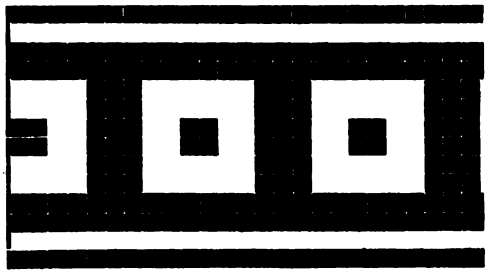


Fig. 6

gown. Knowledge of this kind is worth actual money, for good prices are paid for various forms of hand-work when applied to clothes, to household linens or to fabrics used for decoration about a house. Think of all the different uses we have for borders alone. We use borders on curtains and table runners, on napkins and doilies, on dresses and underclothing, on bags and collars, on towels and pillow cases. All these border designs, whether expressed in lace, embroidery, in crochet or in any other form of needlework, must be invented by somebody. Every girl should be her own designer.

The sketches herewith show one of the simplest ways of beginning the study of design.

Fig. 1 shows a piece of black paper, squared off to represent quarter-inch sections, although in the illustration they are smaller, for convenience. This paper can be bought already prepared, and can be used with white chalk, white crayon, or with a white ink known as *letterine.* In Fig. 2 we see every other square in a certain row filled in with white, which makes the simplest kind of a border. This border is enriched, in Fig. 3, by the addition of marginal bands. The design is now quite complete, and could be worked out in crochet, cross-stitch, or in a variety of simple stitches.

Figs. 4, 5 and 6 show other variations of

this simple way of designing. When you get started at this kind of work, you can hardly keep from making a great number of designs, so interesting is the work and so easy is the process.

However interesting you may find the work on paper, you will enjoy far more working out some of these patterns with actual materials. Fig. 7 was worked in filet crochet. Fig. 8 was worked in a darning stitch, on Russian crash; and Fig. 9 was worked in colored cross stitch on Aida canvas. Any one of these borders may be used in making an article of use and service, for the home. Fig. 12 shows a table runner, made of Russian crash, with the crocheted border used as an insertion. A method of finishing the edge, quite in keeping with the crocheted insertion, is shown in Figs. 10 and 11.

Sometimes we find it easier to design with the materials themselves, rather than to draw designs on paper. There is for sale in the shops a square-meshed open canvas or net, like that represented in Fig. 13. This can be worked in straight-line designs, with single Germantown yarn. The design shown in Fig. 13 is much like the designs in Figs. 4 and 6. It is worked in a simple stitch, with bright orange and black Germantown. Other patterns are shown in Figs. 14 and 15. Borders worked in this style on filet canvas or net can be appliquéd on burlap or any other suitable fabric for a bag. Figs. 16 to 19 show the steps followed in making a shopping bag of brown burlap. A border worked on a strip of filet canvas was button-holed across the bottom of the bag. The color scheme of the border was orange and black. A draw string of twisted orange and black, on which bright orange and blue beads were strung, gave a delightful finish (Fig. 20).

Sometimes the commonest and cheapest fabrics, which show squares, circles or stripes in their patterns, make us think of interesting designs. Figs. 21 to 23 show the possibilities of checked gingham. The color schemes and stitches are given in the appended note. Fig. 25 shows a button bag, made of a piece of ordinary gingham, but the bag looks anything but ordinary because of the unusual design and color it expresses. Satin stitch and couching (Fig. 24) make gingham attractive.

Calicoes and percales are often printed in simple black patterns on white grounds. These patterns may be used as diagrams, upon which we may place a variety of decorative stitches. Fig. 26 shows an ordinary, dotted calico. As a fabric, nothing could be less interesting. But look at the result of a little invention! Fig. 27 shows the steps in working out a simple design, which transforms the uninteresting calico into a bright and attractive trimming, as shown in Fig. 28. The trimming has been used on the cuffs of a little girl's dress as shown in Fig. 29. A variation of the trimming has been used for the girdle and collar.

Other examples of the transformation of cheap and uninteresting fabrics, making them over into real works of art, are shown in Figs. 30 to 32. B.S.

Related Subjects. The following articles in these volumes give further information on the subject of domestic art:

Basketry	Home Economics
China Painting	Industrial Art
Costume	Interior Decorations
Dolls, Paper	Stencil
Embroidery	

DOMESTIC SCIENCE. See HOME ECONOMICS.

DOMESTIC SERVICE, the name applied to service connected with a household, including the labor of those who work in the house, such as cooks, laundresses, chambermaids, waitresses, butlers, footmen and personal attendants, and of those who do outside work, such as coachmen, chauffeurs and gardeners. Domestic service is one of the unorganized industries; that is, there is no fixed standard of wages or of the number of hours constituting a day's work, and very little has been accomplished in the way of organizing servants' unions. So long as this situation prevails the general condition of the household servant will be more or less unsatisfactory. One of the problems of the present day which is interesting students of sociology is the improvement of domestic service by means of organization, and it is the general belief that putting the entire system on a business basis would benefit both employers and servants. This would make it necessary for the workers to take special training courses, as in the other trades, and it would also give them better standing socially.

Much is heard about the "servant-girl problem." Complaint is made continually, by the women who engage girls to work in the home, of the uncertainty of the whole system, of the lack of a standard of excellence and of a fixed term of service, and of the difficulty of securing competent and reliable workers. The fact that large numbers of untrained immigrant girls take up household work as a means of

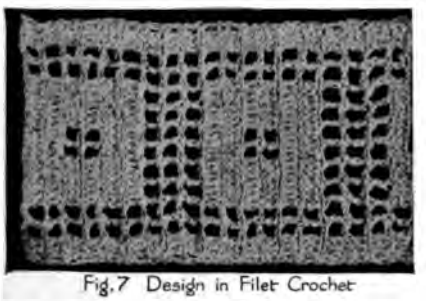


Fig. 7 Design in Filet Crochet

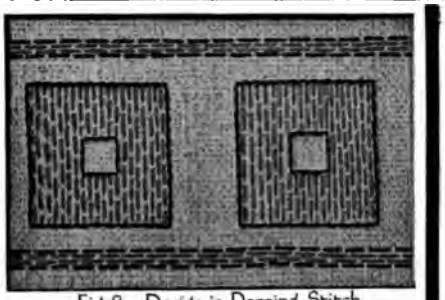


Fig. 8 Design in Darning Stitch

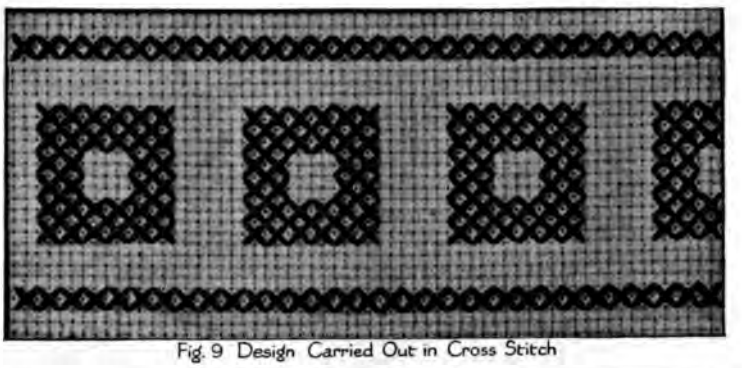


Fig. 9 Design Carried Out in Cross Stitch

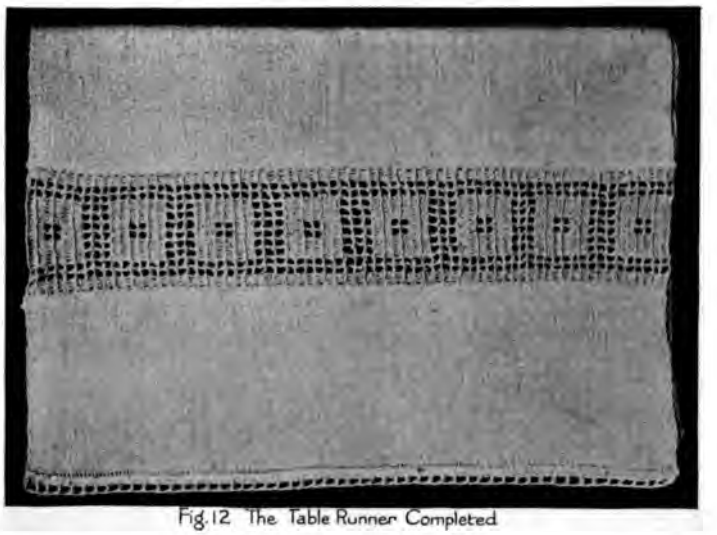


Fig. 12 The Table Runner Completed

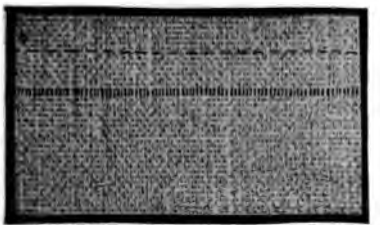


Fig. 10 First Step in Finishing the End

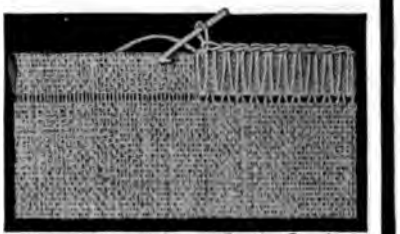


Fig. 11 Second Step · Single Crochet

EXAMPLES OF DOMESTIC ART.

Explanation appears in text-matter.

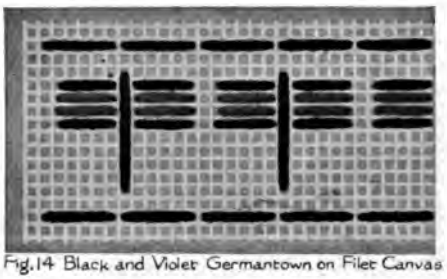


Fig. 14 Black and Violet Germantown on Filet Canvas

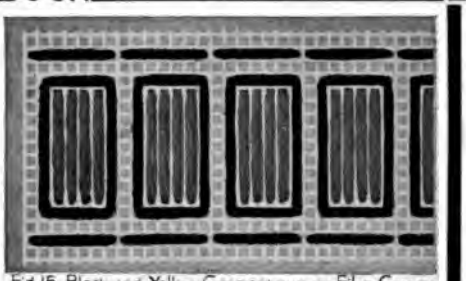


Fig. 15 Black and Yellow Germantown on Filet Canvas

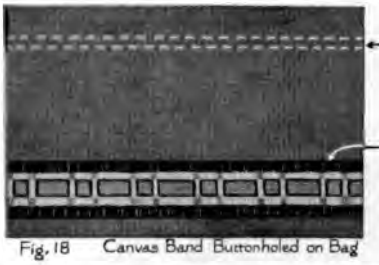


Fig. 18 Canvas Band Buttonholed on Bag

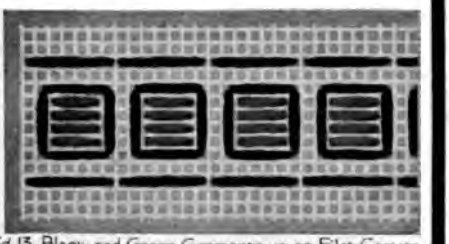


Fig. 13 Black and Green Germantown on Filet Canvas

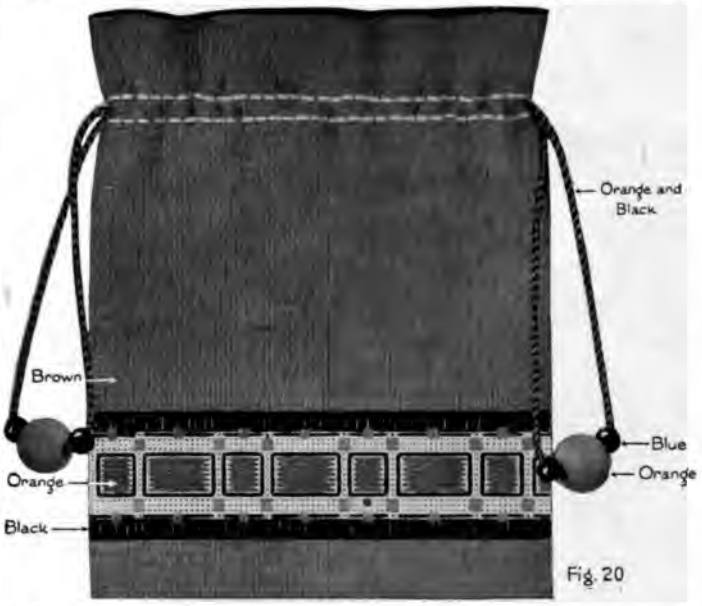


Fig. 20

Fig. 19
Bottom and Side of Bag Sewed in ½" Seams

Fig. 16 15x20" Brown Burlap

Fig. 17 Hem and Draw String Case Completed

EXAMPLES OF DOMESTIC ART.

Explanation appears in text-matter.

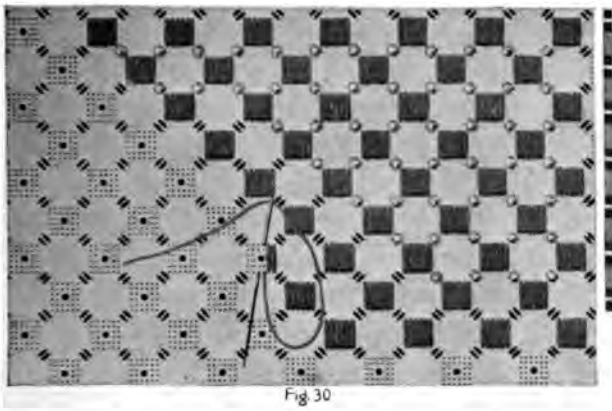


Fig. 30

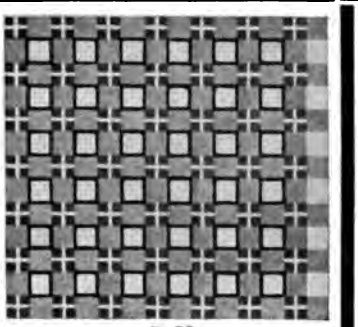


Fig. 23
Violet and White Checked Gingham Worked with Dark Violet and White Cottons

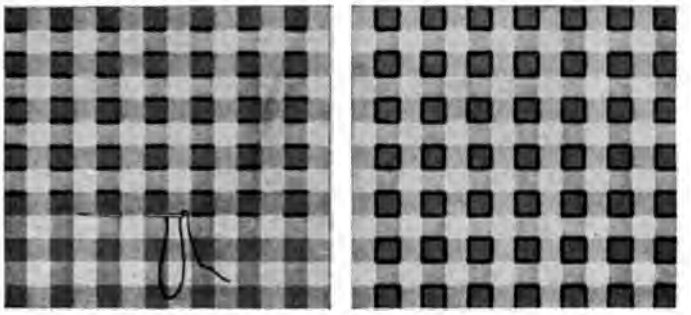


Fig. 22 Blue and White Checked Gingham Worked with Dark Blue Cottons

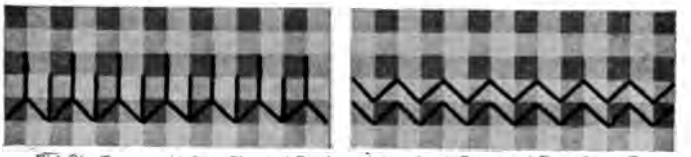


Fig. 21 Green and White Checked Gingham Worked with Green and Dark Green Cottons

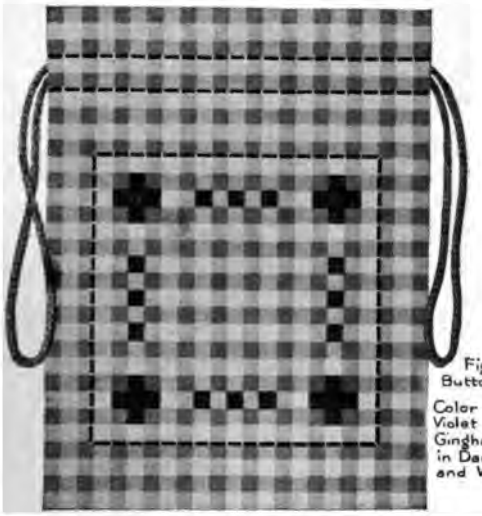


Fig. 25
Button Bag.
Color Scheme. Violet and White Gingham worked in Dark Violet and White

Fig. 24
Satin Stitch and Couching

EXAMPLES OF DOMESTIC ART.

Explanation appears in text-matter.

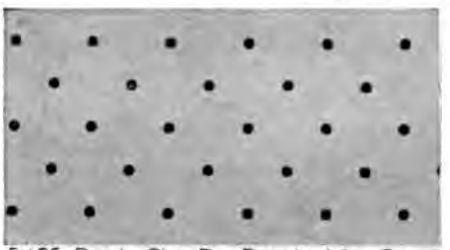


Fig. 26 Percale: Black Dots Printed on White Ground

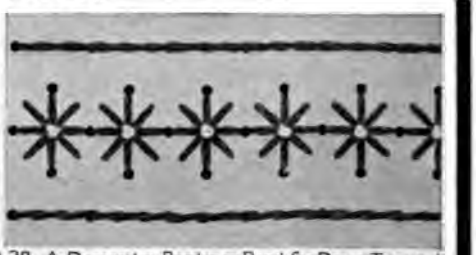
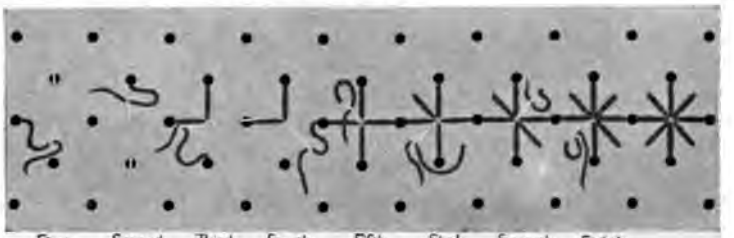


Fig. 28 A Decorative Border or Band for Dress Trimming



First Step | Second Step | Third Step | Fourth Step | Fifth Step | Sixth Step | Seventh Step | Eighth Step

Fig. 27 Stitches Made with Dark Blue Embroidery Floss

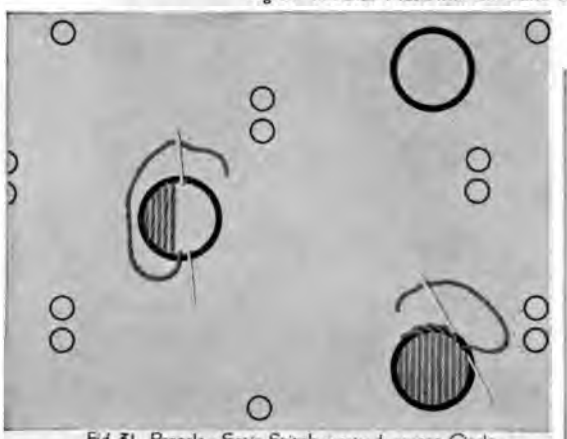


Fig. 31 Percale: Satin Stitch worked across Circle, Outline Stitch around Circle

Fig. 29

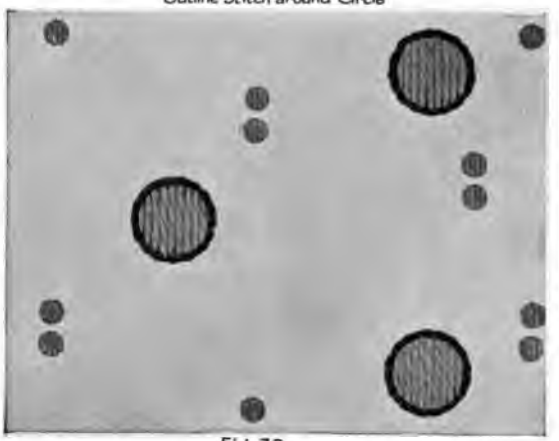


Fig. 32

EXAMPLES OF DOMESTIC ART.

Explanation appears in text-matter.

earning a living is partly responsible for these conditions. There are numerous domestic science schools, which give excellent courses in the various lines of household work, but these do not usually attract the women who become household servants.

Domestic service would seem to be a solution of the problem of the girl who can earn hardly more than living wages in the department store, factory or office. The domestic helper has a comfortable home, and her living expenses are not paid out of her weekly wage. There are, however, two features of domestic service that bring it into disfavor with the average American or Canadian girl; these are lack of personal freedom and the stigma of social inferiority. The factory or office girl has a certain number of hours between the close of one working day and the beginning of the next that she may call absolutely her own. This is a joy denied the girl who works in the household, and the latter, moreover, must always endure the knowledge that she is put socially beneath her sister who works for an industrial firm.

Interesting remedies for the servant problem are suggested from time to time. A wealthy woman of Chicago has successfully adopted the shift system, whereby groups of servants work for eight hours a day, each group relieving another at a specified time. Such a system, however, can only be practiced in the homes of the rich. Some students of the subject favor the abolition of all individual labor and the establishment of nurseries, kitchens, dining rooms, etc., maintained by several families on the plan of coöperation. Such a system has been successfully tried in Brookline, Mass., but its practicability has not yet been thoroughly tested. Every housewife who engages domestic servants can help to make the profession of housekeeping attractive by providing her maid with a comfortable room and adequate bathing facilities, by allowing her a reasonable amount of time off for recreation, and by treating her considerately and kindly. S.L.A.

DOMINICAN REPUBLIC. See SANTO DOMINGO.

DOMINICANS, *do min' i kanz,* also called PREACHING FRIARS, is the name of a religious Order founded in 1215 by Saint Dominic to extend the power of the Church. Their first house was established in France. Pope Honorius III confirmed the Order in 1216 under the rule of Saint Augustine, with special authority to exercise the powers of priesthood. The Order took definite shape in 1220. Originally a preaching Order, it soon became a power in the great universities of the day; to these it contributed many learned men, among them Thomas Aquinas and Albert the Great. Four Dominicans have occupied the Papal chair, and two were distinguished painters, namely, Fra Angelico and Bartolommeo. An order of nuns was established by Saint Dominic in 1206. It was originally an asylum for women, but later developed into an educational institution. The Dominicans practice extreme austerities, including midnight offices, long fasts, strict discipline, total abstinence from meat, and silence. They are bound by the usual priestly vows of poverty, chastity and obedience.

Saint Dominic (1170-1220), founder of the Order of Dominicans, was born in Spain, and educated in the University of Palencia. After his ordination as a Roman Catholic priest he devoted his life to missionary work and to the relief of the poor. In 1215 he went to Rome and spent his remaining years in the organization of the Order of Dominicans. He is said to have arranged the form of prayer known as the *Rosary.* G.W.M.

DOMINION, *do min' yun,* a town in Cape Breton County, Nova Scotia, on Cape Breton Island, twelve miles northeast of Sydney, five miles north from Glace Bay and twenty-seven miles north of Louisburg. It is thirteen miles from the Sydney & Louisburg Railway, with which it is connected by electric tramway. The town is named for the Dominion Coal Company, whose mines in or near the town have an annual output worth $1,000,000 and furnish employment to 2,000 people. Dominion was settled in 1884, and was incorporated as a town in 1906. Population in 1911, 2,589; in 1916, estimated, 3,000. F.J.M.

DOMINION DAY, a national holiday in Canada, to celebrate the confederation of the provinces under one government. In accordance with the British North America Act, the Dominion came into existence on July 1, 1867, and each year the anniversary of this day is celebrated as a holiday throughout the Dominion. It is perhaps the most important holiday of the year. The Union Jack flies from every public building and schoolhouse and from many private homes. Patriotic programs are given in public halls or on village greens, and athletic meets are held and ball games played. The day, in short, expresses the patriotism of the nation, but it is also a day of relaxation and recreation. In the United

States the holiday which corresponds most closely to it in spirit and observance is Independence Day, the Fourth of July. See BRITISH NORTH AMERICA ACT.

DOMINOES, *dom'inoze.* Few indoor games which children play have more fascination for them than dominoes, in which small, rectangular pieces of wood or ivory, plain on one side and divided by a line into two parts on the other side, are used. The blocks are generally black and thus the name *domino,* which is the name of a black mask, was given to the small blocks from which the game gets its name. There are twenty-eight dominoes in a regular set, and these are marked with dots on the side where the line divides the piece into two parts. One of these dominoes is blank on both sides of the dividing line, while the rest are numbered downward through all combinations from double six to double naught.

In playing the game, the dominoes are placed face downward and after mixing them well each player is allowed to choose a certain number, usually five; the first player is the one who has the highest double among his five dominoes. Suppose it is the 4-4. Then the next player must play so that one end will match this domino, for instance a 4-5. The following player must match by playing the 4 or 5. Thus the game goes on, and if one cannot play he draws from the pile left until he gets one which will match. After the pile is all used a player must "pass" if he cannot match—that is, he must miss his turn. The one who first plays off all his dominoes wins, or if the game is blocked, the one who has the lowest number of dots wins. Many special ways for making the game more difficult have been added to the original game, and these are called by different names, such as *muggins, all fives* and *block game.*

This game is valuable as well as interesting to young children, for it teaches them addition, and tends to make them watchful and alert; older children learn much in the power of concentration and planning, as it is a game of skill as well as chance. E.C.

DOMITIAN, *do mish'ian* (51-96), a cruel Roman emperor, whose persecution of Christians and murder of men of talent, learning and wealth finally led to his assassination. During the first part of his fifteen years as ruler many good laws were passed, but his ambition and jealousy soon over-balanced his judgment. After the tyrant had been assassinated with the aid of his wife, the Senate ordered his name erased from all public monuments and books. In the reign of Domitian the Roman general Agricola extended the boundaries of the empire into the interior of Scotland and built a line of forts from the Firth of Forth to the Firth of Clyde.

DON, *dahn,* an important river in Russia, flowing southward from a small lake in the government of Tula. After a course of 1,150 miles it empties into the Sea of Azov. It is navigable for 800 miles from the sea and is important as a commercial route. In its upper course it flows through low-lying, swampy land, but for the greater part it runs through rich agricultural and timber districts. At one point it approaches within thirty-seven miles of the mighty Volga River, with which it is connected by a canal. The waters of the Don carry a great volume of internal products, especially lumber, grain and cattle. It abounds in fish, and the fisheries give employment to thousands of men and women. Its chief tributaries are the Donetz, Sosna, Voronezh, Manytch and Medvieditza. At its mouth is the port of Azov, growing steadily in importance as the river traffic increases.

DONATELLO, *don ah tel'o* (1386-1466), an Italian artist, the founder of modern sculpture. He was the son of a wool merchant, but was early adopted by wealthy relatives, and in their home learned to love things beautiful and artistic. He worked at the goldsmith's trade, and when Brunelleschi, the great architect, was attracted to the boy and took him to Rome, Donatello was at once able to support himself by his skill in working metals. After several years of study of statuary in Rome, Donatello returned to Florence, the home of his childhood, where he made many statues for the cathedral and campanile, besides doing much work for important patrons. His two statues of *Saint Peter* and *Saint Mark* were greatly admired, but when he produced *Saint George,* the man in armor, it was considered his masterpiece. Michelangelo, when he saw it over a hundred years later, stood before it a few moments and then said, "March!" The statue was so real and full of life that it seemed a soldier ready to obey orders.

In 1433 Donatello went again to Rome. His work from that time shows the influence of classic art, but he added to it his own genius, which put motion and grace into his figures. Until his day men had carved their statues as part of the buildings in which they stood. In 1434, when Donatello returned once more

to Florence, he showed how wonderfully a frieze could be made a part of a cathedral, and yet have life in it, when he made the *Singing Gallery*. His equestrian statue, the first of modern sculpture, which he made in 1446, ranks as his best work, but in it he did not quite get away from old traditions, for he had a ball for the horse to rest his foot upon. After traveling widely, Donatello settled in Florence in 1457 with his mother and sister, where he lived simply, unspoiled by praise and success. He was the greatest sculptor of the Italian Renaissance and prepared the way for Michelangelo (which see). E.C.

DONIZETTI, *doh ne dzet'te,* GAETANO (1797-1848), an Italian operatic composer, most widely known through the famous melodious sextette from his opera *Lucia di Lammermoor.* Both that opera and *Lucrezia Borgia* have been called by various admirers his masterpiece. He showed remarkable skill in writing for the voice, but produced his operas so rapidly, writing sixty-four in all, besides other compositions, that, though many are brilliant and effective, all would have been better if they had been given careful revision. Among his operas are *Les Martyrs, La Favorita, Anna Bolena,* the comic opera *Don Pasquale* and the light, sparkling operetta *La Fille du Regiment* (Daughter of the Regiment), all of which have enjoyed great popularity.

DON JUAN, *don hwahn,* a legendary hero of Spain, whose life story has been made the basis for many dramatic and poetic forms. Molière, Corneille, Milton, Mozart, Byron, Dumas, Balzac and Flaubert are among the great poets, writers and musicians who have made this romantic character the subject of their works.

There seems to have been a certain historical foundation for him in the life of a member of the noble family of Tenorio, at Seville. According to the legend, Don Juan cared only for self, and acknowledged no higher obligation than his own will imposed. Failing in his attempt to abduct the daughter of the governor of Seville, he was challenged by her father, whom he killed in a duel. To demonstrate his belief that spirits do not exist, he visited the tomb of the murdered man, ordered a feast to be prepared there and invited the statue to follow him to a revel. To his horror, the "stone figure" accepted the invitation, appeared at table among the guests, promptly compelled Don Juan to follow him and at once delivered the blasphemer over to perdition.

Mozart's famous opera, *Don Giovanni,* made the story popular all over Europe. Byron's *Don Juan* follows the name, and to some extent the character, of the original legend of this ne'er-do-well. In some of the later dramatic versions, other features are introduced attributed to another personage named Don Juan of Maraña, who, through his mother's influence in having masses said for his salvation, ended his days in a monastery where he subjected himself to the severest penance, to atone for a life of debauchery and crime.

DONNELLY, *don'el i,* IGNATIUS (1831-1901), an American prose writer and journalist, who tried to prove that Bacon wrote the works of Shakespeare. He was born in Philadelphia, educated in the public schools, studied law, and was admitted to the bar in 1852. In 1859, after his removal to Saint Paul, Minn., he was elected lieutenant-governor and served as a congressman from that state from 1863 to 1869. He then left the Republican party to become associated with the People's party, receiving nomination from the latter for the Vice-Presidency in 1898. From 1873 to 1878 he was editor of the *Anti-Monopolist* at Saint Louis, and in his later years edited *The Representative* in Minneapolis. His best-known works include *Atlantis, the Antediluvian World, Ragnarok,* and *The Great Cryptogram.* In the latter he attempted to prove the theory of the Baconian authorship of Shakespeare's plays, based on a cipher which he claimed to have personally discovered. His contentions failed deeply to interest the literary world.

DON QUIXOTE (Spanish, *ke ho'ta*), the title of a masterpiece of burlesque in literature, written by Cervantes, which has entertained people of all nations and all times since its publication in two parts, in 1605 and 1615. It is also the name of the hero of the story, the "Knight of the Rueful Countenance."

This book was written to ridicule absurd stories of chivalry which were so popular in the time of Cervantes. Throughout the tale, with its wealth of comedy and its faithful picture of every class of society of the sixteenth century, runs a strain of sadness and keen human understanding. The brave, courteous old gentleman, Don Quixote, his brain filled with the deeds of knights as pictured in books he has read, ventures forth to seek adventure of his own in a world where knight-errantry is no longer known. With him, as squire, goes the simple, faithful Sancho Panza, and together they pass through dangers and many comical episodes,

until Don Quixote falls ill. His belief in knight errantry is shattered, and he dies expressing aversion to books of chivalry.

From *Don Quixote* have come many sayings of popular usage, such as "Murder will out" and "A bird in the hand is worth two in the bush." There has been much discussion as to the proper way for Americans to pronounce "Don Quixote." The Spanish pronunciation is usually heard among educated people, although so eminent a man as James Russell Lowell advocated the simplest English pronunciation—*Don Kwixote*—just as the letters suggest the sounds. See CERVANTES SAAVEDRA, MIGUEL DE.

DOOM, DOUM or DUM PALM, a palm of Upper Egypt and Central Africa, remarkable for having a many-branched stem. It grows both in dense forests and singly in desert sands. Each branch of the doom palm ends in a tuft of deeply-lobed fan-shaped leaves. It bears an irregularly-oval fruit about the size of an apple, with a red outer skin covering a thick, spongy and rather sweet substance which tastes like gingerbread; the palm has often been called the *gingerbread tree.* This pulp furnishes food to the poorer inhabitants of the countries where such trees grow, and an infusion made from it is found cooling and effective in cases of fever. Within each fruit is a horny, semi-transparent seed, which is used as a bead for ornamentation. Ropes are made from the leaf-stalk fibers. See PALM.

DORÉ, *doh ra',* PAUL GUSTAVE (1833-1883), a French painter and sculptor, but preëminently the illustrator of a series of literary masterpieces with which his name will forever be associated. Among them are the Bible, the works of Rabelais, Sue's *The Wandering Jew,* Dante's *Divine Comedy,* Lafontaine's *Fables,* Tennyson's *Idylls of the King,* Coleridge's *Ancient Mariner* and Poe's *Raven.*

He was born at Strassburg and at an early age gave promise of ability; in fact, his fame as an illustrator came so early in life and the demand for his art was so great that he was given but little opportunity for technical training and study. He himself admitted that between 1850 and 1870 he earned £280,000, or $1,400,000, by his pencil. For many years there was a Doré gallery in London, filled with his works, which were more popular there than in France. Among the paintings there were the enormous canvases of *Christ Leaving the Praetorium* and *Christ's Entry into Jerusalem.*

However, he is seen at his best in his book illustrations, interesting especially because of the imaginative power and dramatic sentiment he was able to weave into them. Subjects of a weirdly-humorous character appealed to him most strongly. Doré's popularity extended throughout the United States and Canada, as well as Europe. In addition to his illustrations he did a number of historical paintings in oil and water colors, and had considerable success as a sculptor.

DORIANS, *do'ri ans,* the most conservative and practical of the four great branches of the ancient Greek race, the others being known as Achaeans, Ionians and Aeolians. Long before the period of known history began the Dorians were driven by invaders from their home in Thessaly, on the eastern slopes of the Pindus range, and, moving southward through Central Greece, settled finally in the Peloponnesus. Their most important representatives in historic times were the Spartans (see SPARTA). According to tradition, the Dorians took their name from Dorus, the son of Hellen, who was the legendary ancestor of the Greek race.

DO'RION (in French, *do re oN'*), SIR ANTOINE AIMÉ (1818-1891), a Canadian jurist and statesman, one of the political leaders in the period preceding Confederation, the spokesman of the *Partie Rouge,* or "red party," the radical wing of the French-Canadian Liberals. Later in life he served with distinction for many years as chief justice of the province of Quebec. Dorion was born in the parish of Saint Anne de la Pérade, in Champlain County, Quebec, attended Nicolet College, studied law at Montreal and was called to the bar in 1842. He entered public life in 1854 as a member of the Canadian assembly, in which he sat, except for one interval of several months, until Confederation in 1867. Dorion soon became a leader of the reformers who sought to secure representation by population, or "rep. by pop.," as it was called. In 1856 he suggested a federal union of Upper and Lower Canada, but did not continue to advocate this plan.

On August 2, 1858, he accepted the position of commissioner of Crown lands for Lower Canada in the government headed by George Brown, known generally as the Brown-Dorion Ministry. After holding office for only four days the Ministry resigned, after the assembly had voted a lack of confidence. This was the shortest Ministry in Canadian history. Dorion continued to sit in the assembly, and between 1862 and 1867 was in turn commissioner of Crown lands, provincial secretary and attorney-general for Lower Canada. At the first general

election after the organization of the Dominion he was elected to the House of Commons, and in 1873 was appointed Minister of Justice in the Mackenzie government, but he resigned in the next year to become chief justice of the province of Quebec, an office which he held until 1887.

DORMOUSE, *dawr'mous,* a small, squirrel-like rodent which passes most of its life sleeping; that is, it remains much of the time in a dormant state, hence the name. Various species are common in temperate and warm parts of

A DORMOUSE
About actual size.

Great Britain, Europe, Asia and Africa, but none is known in America, although the common white-footed mouse is sometimes called a dormouse.

The general characteristics of all species are long, squirrel-like tails, two or four pairs of cheek teeth, large heads with rather pointed muzzles, large, prominent eyes and mouselike ears. They are beautiful animals, with hair fine and silky. Like squirrels, they sit up on their hind legs, holding their food of acorns, haselnuts or grain between their forepaws; but unlike the squirrels, they go about at night. All winter they sleep curled into a little ball in their neat nests in bushes, awakening only occasionally on a warm, sunny day to eat from their hoarded store of food.

DORR'S REBELLION, a disturbed condition in the state of Rhode Island from the autumn of 1840 until May, 1842, caused by Thomas Wilson Dorr in the interest of suffrage. After the Revolutionary War Rhode Island was still governed under its charter of 1663, whereby the right to vote was restricted to holders of $134 worth of real estate or land bringing an annual rental of $7, and to their eldest sons.

Dorr voiced the discontent of the people and headed a party for the extension of suffrage to all males of legal age. They held a convention and drafted a constitution; at the same time, the state government, realizing the revolutionary state of affairs, called a legal convention which drafted an equally-liberal constitution. Both were submitted to the people; Dorr's reform document received the majority of votes, but it was declared illegally adopted. By election of the suffragists, Dorr was made governor, and Samuel W. King was elected governor at the regular elections. Dorr and his followers stubbornly attempted to sustain their government by force of arms, but through the aid of United States troops the rebellion was quelled. Dorr was convicted of treason and sentenced to imprisonment for life, but was afterwards pardoned.

Thomas Wilson Dorr (1805-1854) was a member of the Rhode Island legislature in 1833-1837. He was born at Providence, R. I., and was educated at Harvard College. Had it not been for Dorr's agitation, suffrage might not have been extended in Rhode Island for many years.

DORTMUND, *dawrt'moont,* an important mining city in the fertile German province of Westphalia. It is situated near the River Ems, seventy-three miles northeast of Cologne. Although an ancient city, established before the year 900, its growth has been very rapid only during recent years, owing to railway development and the opening up of mines and industries. The iron industry is of great importance, and there are very large plants, some employing as many as 26,000 men. Locomotives, cars and all kinds of heavy machinery are manufactured, and there are numerous breweries, potteries and chemical works. Dortmund was a flourishing member of the Hanseatic League (which see), but steadily declined from the fifteenth century until after the Franco-German War (1870-1871). It then received an impetus which caused it to develop almost as rapidly as any of the western towns of the United States and Canada. Population in 1910, 214,226.

DOUAY, *doo a',* or **DOUAI BIBLE,** the name commonly applied to the translation of

the Vulgate, or Roman version of the Bible, which had been declared by the Council of Trent to be authoritative for English-speaking Catholics. The original Douai edition is the foundation on which practically all the English Catholic versions are based. The New Testament was published at Rheims in 1582, and the Old Testament at Douai in 1609. The work of translating was done by a number of Romanist refugees connected with the seminary and college of Douai and Rheims, under the leadership of Dr. Gregory Martin, a distinguished Greek and Hebrew scholar. Numerous later revisions were made, chiefly to correct the literary style, words of Latin origin having been originally used instead of their simpler English equivalents. The best-known Roman Catholic Bible published in England in modern times is perhaps Haycock's, first issued at Manchester in 1811-1812. In America a revision of the Douay version by Archbishop Kenrick (1849-1850) is much used.

DOUBLE STARS. If you look sharply at Mizar, the star next to the end in the handle of the Big Dipper, you will observe that nestling close to it is a tiny companion called Alcor. Seen through a telescope Mizar would appear to you as a pair of large stars, one white and one green, and with the spectroscope astronomers have discovered that one member of this pair is in fact composed of two stars. Mizar is thus an example of two kinds of double stars. The two parts into which the telescope separates it are really independent of each other, but as we look out upon them from the earth one is almost directly behind the other, and the rays from them find the same spot in the retina of our eye. Alcor and Mizar are called *optical doubles,* because to our unaided eyes they appear companions; similarly, the two parts of Mizar form a *telescopic double.* But the star which the spectroscope separates into two is entirely different. It is called a *physical double,* or *binary system,* because its members revolve about a common point, the center of gravity of their combined masses. Thousands of binary systems are known; more about them will be found in the article ASTRONOMY. See, also, SPECTROSCOPE.

DOUGHTY, *do'ti,* ARTHUR GEORGE (1860-), a Canadian historian, Dominion archivist and keeper of the records since 1904. Dr. Doughty was born at Maidenhead, Berkshire, England, and was educated at Eldon School, London, and at Oxford University. He moved to Canada in 1886 and held several commercial and secretarial positions before his appointment to succeed Douglas Brymner as Dominion archivist. Dr. Doughty was one of the first to realize the necessity of collecting documentary material of Canadian history. He is the author of a number of historical and other works, which are standard; among the best known are *The Siege of Quebec and the Battle of the Plains of Abraham; Quebec under Two Flags; The Cradle of New France,* and *Life and Works of Tennyson.* With Professor Adam Shortt he edited the monumental work entitled *Canada and Its Provinces.*

DOUGLAS, *dug'las,* ARIZ., known locally as the *Smelter City,* is a substantially-built town in Cochise County, in the southeastern corner of the state. It is 217 miles east of El Paso, 650 miles southeast of Los Angeles, and 1,098 miles southwest of Kansas City. It is on the El Paso & Southwestern Railroad, whose western terminus is Tucson, 124 miles west, where it connects with the Southern Pacific. The Nacozari Railroad extends south from Douglas to Nacozari, Mex., an American mining town. The population of Douglas in 1910 was 6,437. The town was founded in 1901 by Dr. James Douglas, head of the Phelps-Dodge interests in Arizona. It was incorporated in 1905.

Douglas probably ships more range stock raised in both Arizona and Mexico than any other border town, and is the market for hundreds of small towns below the border which are supported by mining and cattle raising. West of the city are two large smelters, which receive ore from the rich mines of Bisbee and from the Mexican districts of Nacozari, Arispe, Moctezuma, El Tigre and Pilares. The mineral products are copper, gold, silver, lead and zinc. Prominent buildings of the city include a public library, a country club, a Y. M. C. A. building and the El Paso & Southwestern depot.

In the army maneuvers which followed the Mexican bandit raid on Columbus, N. Mex., in March, 1916, Douglas was an important post. Details of this period of border history are given in the articles MEXICO and UNITED STATES, subtitles *History.* O.K.G.

DOUGLAS, SIR JAMES (1803-1877), a British colonial administrator, regarded as the founder of British Columbia. He was born in British Guiana and spent his boyhood in Scotland, but at the age of sixteen moved to Canada, where he entered the employ of the Northwest Company. When this company was absorbed by the Hudson's Bay Company in 1821, Douglas was sent into the territory west of the Rocky

Mountains. After holding a number of positions under John McLoughlin (1784-1857), he was in 1830 appointed McLoughlin's chief assistant at Fort Vancouver, and finally succeeded him as chief factor. In 1851 Douglas became governor of Vancouver Island, then under the control of the Hudson's Bay Company, and later he also became governor of the Crown colony on the mainland, which was first called New Caledonia and later British Columbia.

Until 1864, when he retired from public life, he was not merely the chief representative of the company, but was also, after the colonies were transferred to the Crown, the royal governor. There is no question that he was an autocrat in office. He observed certain forms of government, and in 1856 even allowed the establishment of representative government in Vancouver Island, but it was the will of Douglas that ruled. The rapid increase in population which followed the discovery of gold on the Fraser River led to demands for a more democratic form of government, with which Douglas had no sympathy. He finally resigned his office because he felt that he could not change his views, yet his bitterest opponents paid tribute to his honesty, courage and ability, and admit that the stimulus which he gave to the colonies justifies his title, the "founder of British Columbia." G.H.L.

DOUGLAS, STEPHEN ARNOLD (1813-1861), an eminent American statesman whose skill as a debater and resourcefulness as a political leader made him one of the most prominent figures during the stormy period before the War of Secession. Small of stature, but with large head and massive shoulders, he was popularly known in his day as "The Little Giant," giving "the image of power under close compression." In American history his name is especially associated with the doctrine of "squatter sovereignty," of which he was the most distinguished champion (see SQUATTER SOVEREIGNTY).

STEPHEN A. DOUGLAS

Douglas was born at Brandon, Vt., and spent the first fifteen years of his life on a farm. A meager country schooling, a year or so of academy training and a course in law constituted his preparation for his public career. Admitted to the bar at Jacksonville, Ill., in 1834, he soon gained a large practice, and having associated himself with the Andrew Jackson Democrats was elected in 1835 to the office of prosecuting attorney for his district. The following year he was sent to the lower house of the state legislature; from 1841 to 1843 he was judge of the supreme court of Illinois, and in 1843 he entered the national House of Representatives. In 1847 he began his first term in the United States Senate, where he was conspicuously before the public until his death.

Soon after his appearance in Congress, Douglas was singled out as one of the most energetic and able of the Democratic leaders. His enthusiasm for the Westward expansion of his country made him a champion of the annexation of Texas and advocate of the Mexican War, and, as he was chosen chairman of the Senate committee on territories, it was his task to introduce bills for organizing the territories of Minnesota, Oregon, New Mexico, Utah, Washington, Kansas and Nebraska. He was soon in the very storm center of the slavery controversy, for the question of admitting the territories as free or slave became the great issue of the hour. In 1854 he reported the famous Kansas-Nebraska Bill (which see), giving to the people of those territories the right of deciding whether or not slavery should be permitted within their boundaries, and therefore bringing the squatter sovereignty principle squarely before the people. The passage of this bill was due to Douglas' brilliant qualities of leadership.

In 1858 he toured the state of Illinois in a stirring campaign for reëlection to the Senate, having for his Republican opponent a man as yet unknown to fame—Abraham Lincoln. In a series of debates that attracted wide interest, the two discussed the whole problem of slavery and its extension. Douglas was playing for two prizes, the Senatorship and the Presidency, a fact which Lincoln knew when he put to his opponent the question—"Can the people of a territory, against the wish of any citizen of the United States, lawfully exclude slavery from its limits before the formation of a state constitution?" Douglas answered "Yes," which pleased his constituents and secured his reëlection to the Senate, but which lost him the support of the Southern Democrats and doubtless the Presidency of the United States. In 1860 he was nominated for the Presidency by

the Northern Democrats, but was repudiated by the South, and in the election won only twelve electoral votes. His popular vote, however, was second to Lincoln's.

From a personal standpoint Douglas was not opposed to slavery, but no one was more loyal than he in upholding the integrity of the Union, and, on the outbreak of the War of Secession, in accordance with Lincoln's request, he began a tour of the border states to arouse enthusiasm for the cause of the North. Two months after the fall of Fort Sumter he died. His grave, in a small park of Chicago, at the foot of Thirty-sixth Street, on the shores of Lake Michigan, is marked by an imposing monument and statue. B.M.W.

Consult Carr's *Stephen A. Douglas;* Brown's *Stephen A. Douglas* in "Riverside Biographical Series."

DOUGLASS, FREDERICK (1817-1895), an American lecturer and journalist, of negro descent, who, even with the great handicap of color, achieved success and honor after his release from slavery. He was born at Tuckahoe, Md., of a white father and a negro mother, whose servitude he shared, according to the law of the time. When he was ten years old he was put to work in a Baltimore shipyard, where he taught himself to read and write. At the age of twenty-one he made his escape from slavery by disguising himself as a sailor. After working for several years as a day laborer in New Bedford, Mass., he brought himself to the attention of the Massachusetts Anti-Slavery Society by a speech made before a convention at Nantucket, and was soon sent out as a lecturer under the auspices of the society. His work took him to England, where money was raised to buy his freedom.

Douglass published an abolition paper for several years before the War of Secession, and in 1870 started *The New National Era* in Washington. In 1871 he was appointed secretary of a commission to Santo Domingo, in 1872 was a Presidential elector from New York, and later became marshal for the District of Columbia, recorder of deeds in the District, and United States minister to Haiti. His autobiography is published under the title, *Life and Times of Frederick Douglass.*

DOUM, *doom,* **PALM.** See DOOM PALM.

DOVE, *duv,* the name applied to the smaller and especially attractive species of pigeons, which, as symbols of love, gentleness, innocence and peace, hold a prominent place in religion, literature and art. Among the birds to which the name has been given are the mourning, ring, ground and scaled doves. To North American residents the best known of these is the *mourning dove,* a member of the turtle dove group (see TURTLE DOVE). The mourning dove, which is found from Quebec to Panama, is so named because of the soft,

THE COMMON DOVE

plaintive, cooing notes with which the male wooes his mate. This bird is about a foot long, and wears a modest coat of fawn color, varying to bluish-gray. In appearance it resembles the wild pigeon. The mourning doves are devoted lovers but careless housekeepers, for the two pretty white eggs are laid in a flimsy nest consisting only of a few sticks loosely thrown together. Sometimes this makeshift home is built on top of a robin's deserted nest. The birds feed on grains and grass and weed seeds. See PIGEON.

There is frequent mention of the dove in the Bible. It was this bird that Noah sent out from the Ark to see if the waters had receded, and which returned with an olive leaf to tell him that the flood was subsiding (*Genesis* VIII). One of these birds rested on the head of Christ after His baptism (*Matthew* III, 16), and later in His ministry He overthrew the seats of those that sold doves in the Temple. In the days of the early Christian Church likenesses of doves, generally with an olive branch, were carved on numberless tombs in the catacombs of Rome and elsewhere, to symbolize eternal peace (see CATACOMBS). At the present time the "dove of peace" is a common feature of cartoons and other pic-

tures representing the end of warfare or the triumph of the principles of peace.

DO'VER, an English seaport, sixty-seven miles southeast of London, on the northern shore of the Strait of Dover. It is beautifully situated, backed by the famous "white cliffs of Dover." On the cliffs to the east of the

CITY AND STRAIT OF DOVER

town stands a castle, founded during the ancient Roman occupation of Britain, and now strongly garrisoned. Stairs tunneled in the cliffs lead from the shore to the fortifications, the road for wheeled traffic taking a long, winding course to the top of the cliffs, 350 feet in height. The harbor is protected by a pier a half mile in length. Calais, the nearest French port, is only twenty-one miles distant, and the fast mail boats accomplish the passage across the strait in slightly over one hour; for this reason Dover is the most important center of traffic with France. It is not a manufacturing town, but conducts a large miscellaneous trade with Belgium, Holland, France and other European countries. Population in 1911, 43,645. See illustration of cliffs, in article ENGLAND.

Strait of Dover, a narrow channel connecting the Atlantic Ocean with the English Channel and separating England from France at their nearest points. It is very shallow, averaging less than 100 feet in depth. The passage from Dover to the French port of Calais, the nearest English and French shores, is greatly dreaded, as the sea is usually rough, and violent storms are frequent. For many years the chief ambition of noted British swimmers was to swim the Channel. The feat was first accomplished in 1875 by Captain Webb, who was in the water for twenty-one and a half hours. A plan for connecting England and France by a tunnel beneath the strait has been repeatedly presented to the two governments but has always been opposed, chiefly for military reasons. As an engineering project it would not be a difficult undertaking.

DOVER, DEL., the capital of the state and the county seat of Kent County. It is on the Saint Jones Creek, near the geographical center of the state and about nine miles from the coast. Wilmington is forty-eight miles north. Transportation is provided by the Pennsylvania Lines (Delaware division). The place was settled as early as 1717. In 1777 it superseded New Castle as the capital of the state, and in 1829 was incorporated as a town. In 1916 the population was 3,720.

Dover is built on high ground and has wide streets crossing each other at right angles. Most of the buildings are constructed of brick, the most prominent being the capitol, built more than 200 years ago, the courthouse and the Federal building. There are also two very old churches, Christ Church (Protestant Episcopal) and the Presbyterian. Besides the public schools, the city has the Wilmington Conference Academy and the State College for colored students, the state library, containing about 50,000 volumes, and a public library. Dover was the birthplace of Caesar Rodney, an American patriot, and his home and a monument erected to his memory are features of interest. The surrounding country produces an abundance of small fruits, and the people of the city are largely engaged in canning fruit, vegetables and meat, especially poultry. The making of baskets and crates is a related industry.

DOVER, N. H., the oldest city in the state and the county seat of Strafford County. It is situated in the southeastern part of the state, at the head of navigation of the Cocheco River, where it meets the waters of the Bellamy River. Portsmouth is eleven miles southeast. Three railway lines serve the city—the Boston & Maine, the Dover & Lakeport and the Portsmouth & Dover; street railway lines communicate with cities north and east. In 1916 the population was 13,272, about the same as in 1910. The area exceeds twenty-six square miles.

Dover is a manufacturing city, largely engaged in making cotton and woolen cloth, boots, shoes, machinery and printing presses; the extensive print works have an output of 30,000,000 yards annually. Within the city's limits the Cocheco River has a direct fall of thirty feet, and its water power is utilized by the manufacturing plants. There are many handsome buildings, the most notable being a $100,000 Federal building, a $225,000 city hall, a public library with over 34,000 volumes, jointly provided by the city and Andrew Carnegie, Wentworth Hospital and the Woodmen

Art Institute. The Strafford Bank is said to be the oldest savings institution in the state.

Dover was settled in 1623, and named for Dover, England. In 1641 it passed under the jurisdiction of Massachusetts, and so remained for fifty years. A city charter was granted in 1855. In the spring of 1896 a flood washed away several bridges, but they have been replaced by modern structures.

DOW, *dou,* NEAL (1804-1897), a Quaker temperance reformer, born in Portland, Me., known as the "father of the Maine law," and one of the most effective temperance advocates in American history. He was educated at the Friends' School in New Bedford, Mass., subsequently becoming a merchant and rising to a high position in the business and political life of his native city. The temperance question, however, was his chief interest, and he was an ardent champion of the prohibition of the manufacture and sale of intoxicating drinks. In 1851, the same year that he drafted Maine's famous prohibitory law, he was elected mayor of Portland and was reëlected in 1855. In 1858 he served in the state legislature. Early in the War of Secession he became colonel of the 13th Volunteer Infantry and was commissioned brigadier-general of volunteers in 1862. In the attack on Port Hudson he was twice wounded, was taken prisoner, and spent eight months in Libby Prison. At the close of the war he traveled in the United States, Canada and Great Britain, organizing prohibition leagues, and through his efforts the prohibition amendment was added in 1884 to the Maine constitution. The National Prohibition party made him its candidate for President in 1880.

DOW'DEN, EDWARD (1843-1913), an English educator and literary critic, one of the most distinguished of modern Shakespearean scholars. He was born in Cork, Ireland, and was educated at Trinity College, Dublin, where he began teaching oratory when he was twenty-four years of age. Later he was appointed professor of English literature in the college, a position which he held until his death. His scholarly *Shakespeare: His Mind and Art,* which was published in 1875, gave him a reputation that was fully sustained by succeeding volumes of literary biography, criticism and history. Notable among these are *The Shakespeare Primer,* a treasure-house of information in concise form; *New Studies in Literature;* a *Life of Shelley; Introduction to Shakespeare,* and *A History of French Literature.* He also edited Shakespeare's sonnets and several of his plays, and the poetical works of Shelley, Wordsworth and Southey.

DOW'IE, JOHN ALEXANDER (1847-1907), a religious organizer and teacher, who had a remarkable career in America as the founder of a church based on his doctrine of healing by faith. He was born in Edinburgh, Scotland, began his religious work as pastor of Congregationalist churches in Sydney, Australia, and later took up evangelistic work because of his conviction that it was wrong for a minister to accept a salary. About 1882, when he established a tabernacle in Melbourne, he became a convert to the doctrine that bodily ills should be healed by the "prayer of faith." Six years later he emigrated to the United States to organize a church which should be founded on his beliefs.

Establishing himself in Chicago, he gained thousands of followers, and by 1896 his Christian Catholic Church had become widely known. In 1901 he moved its headquarters to Zion City, forty-two miles north of Chicago, a community founded on the prairie, which at once grew to a town of several thousand people. In that city he established a publishing house, a bank, a college, many charitable institutions and various industrial works, famous among which is a great lace factory now owned by Marshall Field & Company. Over all of these enterprises, and over the conduct of his people, Dowie exercised the power of a dictator. He forbade many things commonly practiced elsewhere; for example, he denied men the right to smoke within the city limits, and he decreed that no one might dance or play cards. When, in 1906, a revolt of his followers deposed him, he was planning to extend the influence of his Church throughout the world. Previously he had announced himself as Elijah II. A year after his fall from leadership he died. Wilbur Glenn Voliva succeeded him in the post of chief authority.

DOYLE, *doil,* SIR ARTHUR CONAN (1859-), a British novelist who created one of the most widely-known characters in modern English fiction—the fascinating detective, Sherlock Holmes. The stories in which he appears—*A Study in Scarlet, The Adventures of Sherlock Holmes, The Hound of the Baskervilles* and others—are more than ingenious detective tales, for they show the author's humor, insight into character and sense of the dramatic, and at times are enveloped in an atmosphere of horror and mystery that is suggestive of Edgar Allan Poe.

Doyle was born in Edinburgh and studied medicine in the university of that city and in Stonyhurst College (England). He practiced as a doctor at Southsea between 1882 and 1890, making an attempt at story-writing in the meantime, and winning success in 1887 with *A Study in Scarlet.* This was followed by its companion volumes and by several historical novels, including *Micah Clarke, The White Company, The Adventures of Gerard* and *Sir Nigel;* the last is considered by many critics to be his best work in historical fiction. *Round the Red Lamp, The Stark Munro Letters* and *The Green Flag and Other Stories* are volumes of short stories; he has also written a book of poems called *Songs of Action* and a play entitled *Halves.* Among his latest stories are *The Poison Belt* and *The Case of Oscar Slater.*

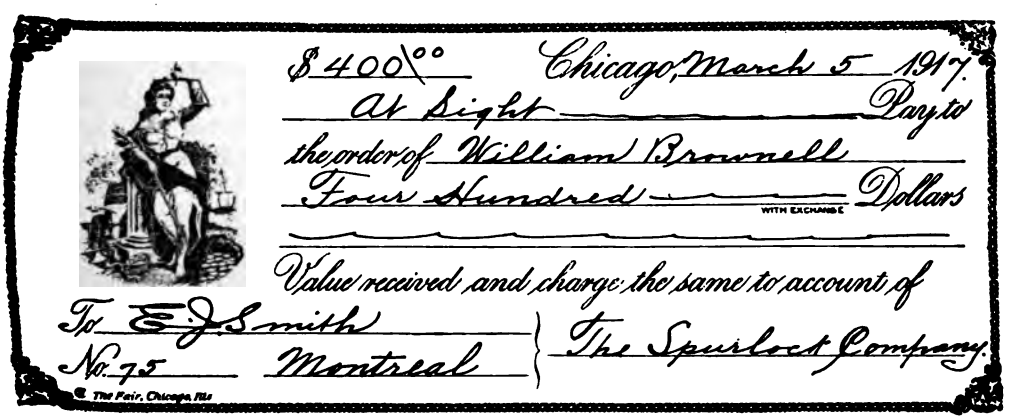
A. CONAN DOYLE

Doyle gave his services to England during the Boer War, acting as senior physician of a field hospital, and on his return home published *The Great Boer War,* a military history of the struggle. Later he vigorously upheld the British policy in South Africa in *The Cause and Conduct of the War,* a book widely read, and translated into twelve languages. In 1902 the British government knighted him in recognition of his distinguished services to his country.

DRACHMA, *drak'ma,* the name of a silver coin which is the monetary unit of Greece. It is of the same value as the French franc and is worth 19.3 cents in United States and Canadian money. A drachma is divided into 100 *lepta,* each worth .193 cent (nearly two mills). Among the ancient Greeks the drachma was also the unit of weight. It varied considerably in different localities and has only recently become standardized. The modern drachma in weight is equal to the metric *gram,* or 15.433 grains. See COINS, FOREIGN.

DRACO, *dra'ko,* an Athenian statesman and legislator who in 621 B.C. drew up a code of the common law of Athens. These written laws in no way altered the laws already established, but when written they appeared so harsh that they were said to have been written in blood. The only penalty named was death, no matter what the offense. Solon later altered many of these laws, but retained the death penalty for murder. It is said that Draco met his death at Aegina, being accidentally smothered in a theater beneath the great number of garments and caps thrown on him by the over-enthusiastic people.

DRAFT, the name popularly given to any bill of exchange (which see), and more particularly to a bill of exchange drawn by one bank on another in favor of a third party. With the exception of the check, the draft is the form of negotiable paper most commonly in use in ordinary business transactions. Its use is easily illustrated by an example. Mr. A in New York owes $500 to Mr. B in Toronto.



ONE FORM OF DRAFT

In case The Spurlock Company did not owe William Brownell, yet wished to draw on Smith for $400, in place of Brownell's name as payee there could be written the name of the bank with which the drawer does business. The bank then would send the draft to a Montreal bank for presentation and payment.

Mr. A has money in New York, but not in Toronto. So he goes to his New York bank, which has money on deposit in a Toronto bank or whose credit with it is assured, and gets a draft for $500, made payable by the Toronto bank to Mr. B. When B gets the draft he presents it for payment at the Toronto bank. The latter makes the payment and in turn charges the amount to the New York bank. In this way A's debt is discharged.

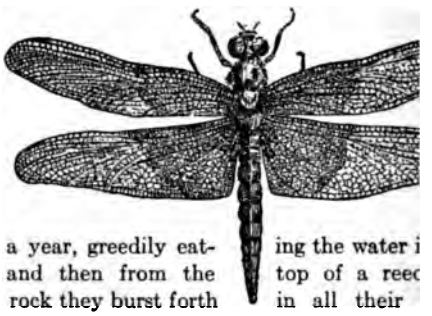
A draft, on the other hand, may be used in another way to secure payment of money. Suppose the Spurlock Company of Chicago owes William Brownell of Montreal, and that E. J. Smith, also of Montreal, owes the Spurlock Company. The latter may write such a draft as is shown in the illustration and tender it to Brownell in payment of its debt to him. When Smith pays Brownell as requested, a three-cornered indebtedness is cancelled. If a draft reads "pay *at sight*" or "*on demand*," a debtor must at once either pay the amount of the draft or reject it. If the draft is payable in sixty days he may *accept* it, thereby agreeing to pay it. His acceptance is indicated by the word *Accepted* and *his signature* on the face of the draft. After the draft is accepted he is legally responsible for its amount, for it is then, in effect, a note. If he fails to pay at the time fixed, he may be sued without further notice. See, also, CHECK; NEGOTIABLE INSTRUMENTS.

DRAFTING. See CONSCRIPTION.

DRAGON, *drag'un,* a name which most commonly belongs to the harmless East Indian *flying lizard,* of beautiful, butterfly hues, but is also applied to various tree-lizards of Southern California, South America, Asia and Africa. The *flying lizard* is about eight inches long.

In legends and myths the dragon is the emblem of evil, and in Christian art it is pictured as a fierce, winged crocodile, breathing fire. The Chinese regard the dragon as a divinity, and have adopted it as their imperial emblem.

DRAGON FLY, a beautiful water insect, with large, long, gauzelike wings that give it powerful and rapid flight. A "glimmering, glittering flutterer fair," dressed in beautiful greens and blues and browns, it is as attractive and interesting as the butterfly. It has very large beadlike eyes and a long, slender body, and is widely known as the *devil's darning needle.* To this always-hungry but absolutely harmless insect are attributed many strange actions. It lives merely on other insects, chiefly mosquitoes and flies, and usually catches and eats them while flying over the pon marshes where it lives. It is therefore a l to humanity. The dragon fly lays its e the water, where the pupae (young) li



a year, greedily eating the water i and then from the top of a reec rock they burst forth in all their beauty. Dragon flies migrate like birc the reason for their flight has not been mined.

DRAIN'AGE. How many farmers believe you if told that they could incre size of their farms without enlarging boundaries? The proposition seems absu it is a fact that the average farm co increased in *depth.* The deeper the roo plant penetrate the soil the more nouri they can extract, and artificial draina lowering the level at which water satura soil and shuts out air, enables roots to farther below the surface. A farmer ou to be content with having his fields fre standing surface-water; if a post hole five feet deep contains water during the growing season he will gain by in a drainage system.

In a large part of the United Stat Canada rain falls more rapidly than e tion, natural drainage, seepage through and absorption by plants can dispose of the line of saturation, called the *wate* is not very far below the surface. In cl moisture rises more than four feet abc water-table just as ink climbs in a p blotting-paper (see CAPILLARITY), and i it rises nearly two feet.

The Best Way to Drain. Open ditc seldom satisfactory on a farm. They part of the tillable area, obstruct mo and sometimes become filled with wee breed mosquitoes. Underground drai much more effective, especially when bu hollow tile.

There are no fixed rules for the la underground drains. The character of t the lay of the land and the amount o to be carried must be considered in ea

known as *acts* and *scenes*. When presented on a stage the story is developed by means of speech, action and gesture, and with the aid of stage scenery and furnishings. The term *drama* is also applied to the entire body of dramatic writings of any people or period, as the English drama, medieval drama, and the like. The dramatic writings of nearly all nations are an important part of their literature.

Plays are written both in prose and in poetry. The Greeks, who originated European drama, considered this form of literature one of the divisions of poetry, and Shakespeare's plays are for the most part written in verse; but in modern times prose has been more generally used than poetry as a medium for dramatic composition. The two great divisions of the drama are *tragedy* and *comedy*. Tragedies are plays with a gloomy ending, in which the sad or terrible in life is emphasized; in a comedy the outlook on life is gay or cheerful, and there is a happy conclusion. Shakespeare's *Hamlet* is a tragedy; his *Twelfth Night* is a comedy.

American Drama. America has produced an extensive dramatic literature, though much of this is not of high value. American dramatists have shown the greatest activity in the period beginning about 1880. In the latter part of the nineteenth century a form of play became popular in which the interest is centered upon native types of character rather than upon the plot. Denman Thompson's *Old Homestead* (1886) and James A. Herne's *Shore Acres* (1892) are well-known plays of this type. Bronson Howard (1842-1908), one of America's most able dramatists, is remembered for his attractive and spirited comedy, *The Henrietta* (1887), revived in 1913-1914 as *The New Henrietta*, and for his popular war drama *Shenandoah* (1889). Augustus M. Thomas (born 1859), whose fondness for local color is shown in his most popular plays, *Alabama*, *In Mizzoura* and *Arizona*, also achieved success with a striking play dealing with the power of hypnotism, *The Witching Hour*. Among other well-known plays is his *As a Man Thinks*.

Notable work has also been done by William Gillette (born 1855), who made an able dramatization of Doyle's *Sherlock Holmes* and won a high place for himself in the dramatic world in its title rôle. *Secret Service*, a drama of the War of Secession, and *The Private Secretary*, a delightful and entertaining comedy, are among [illegible] other successes. The drama of social life [illegible]en represented by Clyde Fitch (1865- notably in *The Climbers*, *The Truth* and *The Girl with the Green Eyes*. He produced more plays during a brief career than any other American. Typical phases of modern American life have been treated by Eugene Walter (born 1874) in *The Easiest Way*, *Paid in Full* and *Fine Feathers*, and Edward Sheldon (born 1886) gave a realistic portrayal of slum life in *Salvation Nell*. The well-known theatrical producer and manager, David Belasco (born 1859), has written a number of successful plays, notably *The Heart of Maryland* and *The Girl of the Golden West*.

The chief representative of the poetic drama is Percy Mackaye (born 1875), whose *Jeanne d'Arc* and *Sappho and Phaon* show literary merit. William Vaughn Moody, who died in 1910, gave promise of unusual power in his *Great Divide* (1907), possibly the most artistic of all American prose dramas.

The American drama has reached a higher standard of excellence in its players than in its plays. Among the earlier artists, the names of Edwin Forrest, Edwin Booth, Lawrence Barrett and Richard Mansfield shine brilliantly. Joseph Jefferson, whose portrayal of Rip Van Winkle is one of the cherished traditions of the American stage, was long a well-loved figure in the theater.

Notable among later artists are John Drew, Edward H. Sothern, Robert Mantell, William Gillette, William Faversham, William Crane, Henry E. Dixey, Nat Goodwin, Francis Wilson, Maude Adams, Julia Marlowe, Annie Russell, Minnie Maddern Fiske and Mrs. Leslie Carter.

Some Present-Day Difficulties. The American theater since 1910 has shown the effects of rather extraordinary conditions. One of the most commonly-heard complaints on the part of the theatrical producers is that the regular theater no longer enjoys the popularity it once commanded. Undoubtedly the immense vogue of the moving picture and vaudeville programs has diverted the public from the regular playhouses, where, it is generally admitted, the prices charged are often excessive. Plays of genuine merit are the exception, and a person who has paid well to see an inferior play poorly acted is not inclined often to repeat the experiment.

The formation of a theatrical combination, known as the "Syndicate," has also affected the situation. This combination of theatrical managers controlled in 1896 thirty-seven first-class theaters; by 1915 nearly all the standard playhouses in the United States had passed under its control. To the producer the Syndi-

AN OUTLINE ON THE DRAMA

I. Forms

(1) Tragedy—the loftiest form
  (a) Subject-matter—grave
  (b) Language—dignified
  (c) Object—as phrased by Aristotle, "to purify the passions"
(2) Comedy
  (a) Less serious than tragedy
  (b) Language and treatment lighter than in tragedy
  (c) To amuse, or occasionally to ridicule
(3) Farce
  (a) A form of comedy, more extravagant than the latter. Comedy generally aims at realism; farce introduces obvious absurdities
  (b) Motive, to excite laughter
(4) Burlesque
  (a) A ludicrous treatment of serious matters, or a dignified, lofty treatment of unimportant things
  (b) Motive, originally to correct abuses or absurdities through ridicule
(5) Opera
  (a) Drama set to music
  (b) Divisions
    1. Grand opera—serious or classical themes, usually like those of tragedy
    2. Light opera—fanciful or humorous, or even comic. Music lighter and less impressive than in grand opera
(6) Transition forms, now practically obsolete
  (a) Mystery plays—based on Bible stories
  (b) Miracle plays—dealing with the life of some saint
  (c) Morality plays—moral teaching in dramatic form, the characters representing the virtues and vices
  (d) Pastoral—a presentation, usually idealized, of rural scenes and happenings

II. Historic Development

(1) Among the Hebrews
  (a) *Job* and *Song of Solomon* practically dramas
(2) In India
  (a) Drama reaches far back, but has never reached the high plane of Greek or later European dramatic writing
(3) In China
  (a) Very long and complex dramas
  (b) Unknown to people outside of China
(4) In Greece
  (a) Greeks originated both forms, tragedy and comedy
  (b) Tragedy religious in its beginnings, an outgrowth of the worship of Dionysus
  (c) Comedy, similar in its origin, but growing out of the rural festivals
(5) In Rome
  (a) Largely imitation of Greek drama
  (b) Its influence, rather than that of Greek drama, felt in later European literature
(6) Italy
  (a) Classic model strictly adhered to during early period
  (b) Age of the pastoral drama, during fourteenth, fifteenth and sixteenth centuries, foremost period
  (c) Seventeenth century saw a lessening of interest, but the following century was marked by a decided revival.
  (d) It was from Italy that English dramatic tradition which resulted in the wonderful dramas of the Elizabethans was derived
(7) France
  (a) Corneille real founder of French drama, which amounted to little before his time
  (b) Racine and Molière next outstanding names
  (c) Classic school represented by these writers remained dominant until the early nineteenth century, when Hugo became the leader of a new school, the romantic
(8) Germany
  (a) Early dramas all modeled on French; many merely translated from French
  (b) Lessing first to break away from French tradition
  (c) Goethe and Schiller culmination of dramatic writing in Germany
(9) England
  (a) Most brilliant period that of Queen Elizabeth; Marlowe, Jonson and Shakespeare greatest writers
  (b) Theaters closed by Puritans
  (c) Drama of the Restoration—Dryden chief figure
  (d) Excellent comedies of eighteenth century
  (e) Present-day tendencies
(10) Canada
  (a) Some original productions of merit, but most of the dramas brought from England
(11) United States
  (a) No plays to rank with great productions of English dramatists
  (b) "Character" plays
  (c) Realistic dramas of modern life

cate says, "You must book your plays in our theaters, or they will get no hearing"; and to the actor, "You must play in our theaters, or you will get no employment." Such a system tends to discourage independence on the part of the actor, and it reacts on the playwright. An outsider cannot get his plays produced in any theater which will insure him a wide hearing. Furthermore, the members of the Syndicate have a tremendous influence with the press, and in some cases they control dramatic critics. In New York a theatrical manager may forbid a dramatic critic who has criticised one of his productions to enter his theater.

The Beginnings of European Drama. Many centuries before the Christian Era the ancient Greeks were accustomed to celebrate with music and dance the festival of Dionysus, their god of wine, and the Greek drama was the outgrowth of the songs of the festival chorus (see CHORUS). Verses and dialogues were introduced in the course of time, and early in the sixth century B.C. an actor was added to the chorus. Aeschylus (525 B.C.), the first great writer of tragedy, introduced a second actor; he was also the first to make use of appropriate scenery and costumes. As time passed the chorus became secondary to the action of the play, and Sophocles, one of the successors of Aeschylus, introduced a third actor. Aeschylus, Sophocles and Euripides formed the great trio of tragic poets.

Comedy, which developed side by side with tragedy, was the outgrowth of the fun and frolic of the rustic festivals held in honor of Dionysus. Early in the history of comedy the chorus disappeared. Ancient Greek tragedy was religious in character; comedy was used to hold up to ridicule the prominent men of the day, and from this phase it passed to the ridicule of the weaknesses of humanity in general. The greatest of the Greek writers of comedy was Aristophanes. His greatest comedy is undoubtedly *The Clouds,* in which Socrates is ridiculed.

The Middle Ages. The typical dramatic forms of medieval Europe had their birth in the services of the Christian Church. In order to make the Bible teachings more vivid and impressive, the clergy began to present the chief episodes in the life of Christ in the form of little plays, especially during the celebration of the great festivals of Easter and Christmas. Gradually these plays were banished from the churches, and were performed on the streets and in the public squares by actors.

Three important forms of the medieval drama developed: the *mystery play,* based upon Bible stories centering particularly about the life of Christ; the *miracle play,* a series of episodes taken from the life of some saint; and the *morality play,* which was really a sermon in dramatic form, its characters being types of certain virtues and vices. *Everyman,* one of the best morality plays in English, was revived in 1902 and 1903 in England and America by the Ben Greet players. *The Passion Play,* performed every tenth year at Oberammergau, is a form of mystery play.

The Drama in England. The various forms of the religious drama were long popular in England, but in the fifteenth century the revival of learning awakened an interest in the old classic plays, and the regular English drama began to take form. Schoolmasters trained their pupils to act the comedies of the Roman dramatists, Terence and Plautus, and about 1536 Nicholas Udall, head master of Eton, wrote the first English comedy, *Ralph Roister Doister.* This was followed fifteen years later by the first English tragedy, *Gorboduc.*

During the reign of Queen Elizabeth the English drama reached its highest degree of excellence in the plays of Shakespeare. With the passing of the Elizabethan Era the drama began to decline. In 1642 the theaters were closed by the Puritans, but on the restoration of Charles II in 1660 interest in them revived. The chief dramatist of the Restoration Period was John Dryden, whose plays, as well as those of his contemporaries, reflect the coarseness and corruption of the age in which they were produced. The eighteenth century produced admirable examples of the English comedy of manners, notably Richard B. Sheridan's *The Rivals* and *The School for Scandal,* and Oliver Goldsmith's *She Stoops to Conquer.*

The poetic plays of Tennyson, Swinburne and Browning, though not suited to presentation on the stage, are excellent representatives of the nineteenth-century literary drama. Notable writers of the acted drama include Bulwer Lytton, Shirley Brooks, Charles Reade, Dion Boucicault, Oscar Wilde and W. S. Gilbert.

Prominent English dramatists of the modern period are Bernard Shaw, Granville Barker, Somerset Maugham, Haddon Chambers, Henry Arthur Jones, Arthur W. Pinero, James A. Barrie and John Galsworthy. Shaw is the most brilliant and original of those dramatists who aim to give on the stage a picture of the life and characteristics of the times, and he has become an international figure. C.W.E.

Courtesy of
Florence Holbrook

MIDSUMMER NIGHTS DREAM. (1) The bewitched fairy and her lover. (2) Preparing for that "most lamentable comedy." (3) The fate of Hermia hangs in the balance.

Courtesy of
Florence Holbrook

***MIDSUMMER* NIGHTS DREAM.** (1) The fairy queen. (2) "Fair lovers, fortunately met"—happy at last. (3) Puck and the fairies.

Shakespearean Drama in Schools

One of the best and most enjoyable exercises for a class is the presentation of a play. All children like to "make believe," and knowledge of a play is best obtained by the endeavor to memorize the lines and to present the thought by appropriate intonation and gesture. No more time is required to present a good literary play than a worthless, transitory effort; young people should therefore be encouraged to select some play of recognized merit. One of the simplest and most charming of all plays for children is the wonderful fairy play of Shakespeare, *Midsummer Night's Dream*. The ideal way is to have a class give this play after it has been carefully studied in school as part of the regular work in literature. The students are then familiar with the entire play and can easily memorize the beautiful lines. High school classes have presented it well, while children in the seventh grade, under twelve years of age, have given the play in a most acceptable and enjoyable performance, delightful in its quaint conceits and humor as well as in its beauty of expression.

The play is easily staged, as all the action, except the first and last scenes, takes place in the forest. A dark-blue curtain as the background, with a tree trimmed with pink paper to represent a blossoming cherry tree, four sloping benches covered with green for the resting places of the tired wanderers in the wood, and a throne for Titania and Bottom, her grotesque lover, complete the forest setting. The stage may be thus arranged, and no drop curtain is necessary. The first scene may be given at the front of the stage, close to the audience. In the last scene the throne should be covered with white for the throne of the duke and duchess; the four green benches should be removed and a classic white bench should be placed for the seats of the lovers as they enter to the presentation of that "most lamentable comedy," Pyramus and Thisbe.

Costumes. There are three groups in the play. These are the *courtiers*, who wear handsome Greek dresses of various colors, made of crêpe cloth and trimmed with the Greek border; the *clowns*, who wear plain, short-skirted slips of dark colors, with dark hose and sandals; and the *fairies*, who should wear sheer garments and wings trimmed with silver and gold. Puck should wear scarlet and have winged cap and sandals; a fairy should wear pale blue, trimmed with silver; the four fairy attendants of Titania should be tiny boys dressed in colors appropriate to their names and wear huge wings and wreaths of flowers. The ass's head that Bottom wears in the forest, the lion's head, the crowns and Oberon's wand may be rented from a costumer. The lantern, bush of thorn and dog that Moonshine must have can easily be obtained. The little children who give the roundel should wear cheesecloth in soft colors, while the dance that follows the play in the last act may be given by other dancers in white costumes. The girls in the sewing classes should make all the dresses. Egeus should wear a white beard and wig. Thisbe should have the long dress of a Greek lady, and the clowns should have swords. Flute should have a bag with the scrolls for the actors and one much longer scroll for the calendar.

The four fairies, taken from the kindergarten or first grade; the dancers, from the third and fourth grades, and the other actors from the sixth and seventh grades, serve to interest many children in the presentation. The story of the play should be told to the younger classes by the members of the class that has studied it, that they may better appreciate its presentation.

One invaluable result of presenting such a play is that the study and time are not misspent. The world of literature will always be better known and more highly enjoyed because of this early excursion into one of its most alluring paths. F.H.

Consult Hunt's *The Play of To-day;* Moses' *The American Dramatist;* Eaton's *The American Stage of To-day.*

Related Subjects. These volumes contain many articles which throw light on the subject of the drama:

GENERAL

Becky Sharp
Burlesque
Camille
Comedy
Farce
Figaro
Hamlet
Macbeth
Masque
Melodrama
Midsummer Night's Dream
Miracle Play
Morality Play
Mystery Play
Opera
Passion Play
Rip Van Winkle
Theater
Tragedy

DRAMATISTS

Ade, George
Aeschylus
Alfieri, Vittorio
Aristophanes
Beaumarchais, Pierre Augustin Caron de
Beaumont, Francis and Fletcher, John
Belasco, David
Boucicault, Dion
Corneille, Pierre
Daly, John Augustin

the important factors that led to the War of Secession. See UNITED STATES, subtitle *History;* War of SECESSION.

DRESDEN, *drez'den,* the city of zest in nature and art, of hearty river life and pleasure, is the capital of the kingdom of Saxony, in the German Empire. It is situated in a richly-cultivated valley on both sides of the Elbe River, about 111 miles southeast of Berlin. Because of its delightful situation and its many objects of interest it often is called "the German Florence." Numerous squares and parks dot the city, both in the old and new sections, the largest being the Grosse Garten, in the old quarter, containing a museum of antiquities and a zoölogical and botanical garden. Among its fine promenades is the Brühl Terrace, commanding a charming view of the Elbe and surrounding country, once a part of the city's fortifications before Count Brühl, the all-powerful minister of Augustus II, made them over into his private gardens.

In addition to its imposing churches, Dresden takes pride in its many beautiful public buildings. Among these are the Zwinger, originally intended to be the vestibule of a magnificent palace, but now housing collections of great value, whose northeast wing forms the Museum, containing one of the finest picture galleries in the world; the Augusteum, or Japanese Palace (so named from Oriental figures with which it is decorated), containing the royal library of about 400,000 volumes and a valuable collection of manuscripts and portfolios; and the Johanneum, which in addition to its 15,000 pieces of rare porcelain contains an historical museum with a fine array of arms, armor and domestic utensils belonging to the Middle Ages. The splendid interior decoration of the royal palace and its collections of curiosities, jewels, trinkets and works of art more than compensate for its unattractive exterior; while the prince's palace has a fine chapel and a library of 20,000 volumes. The royal theater is one of the finest of its kind in the world. Dresden is also noted for its excellent educational, literary and artistic institutions, chief among which are the Royal Technical High School, the Royal Music School and the Academy of Medicine and Surgery.

The city is classed among the neatest of the cities of Germany. The municipality owns and manages its water works and its gas and electric plants. In manufactures, which are varied in character, it ranks high, although the china for which the city is famed is chiefly made at the royal factories at Meissen, fourteen tant (see DRESDEN CHINA). Dresd severely in the Thirty Years' War. 1813, when Napoleon made it his h The Prussians occupied it in 1866, ated it in 1867. Population in 1910,

Arts and Crafts in Dresden. A of Dresden's claim to fame lies in i art, literary and scientific collection the most valuable is its picture gall in the Museum of the Zwinger, cont 2,500 canvases, representative of Italian, Spanish and Flemish maste its prize pictures are Raphael's *S donna;* Correggio's *Holy Night;* T *Tribute Money,* and Rubens' *Boar* museum owes its most valued treas gustus III, who purchased the gre of the gallery of the Duke of M $900,000. This treasure storehouse c over 300,000 wood cuts and copper and while its modern gallery is sm tents it is representative of the l modern schools. The collection of royal playthings in the famous Gre the royal palace likewise is famed the array of ancient and modern a ments and costumes in the Muse neum.

DRESDEN CHINA, a delicate, ished porcelain, named from the C where it is supposed to be manufact ever, the credit for producing it bel Dresden but to the capable men employed at the royal factory at M teen miles from that city. Porcelai continued in popular favor ever s first made in 1709, when Johann Fri ger, chemist to the elector of Sax ered the yellowish-white material, c of which it is made, in the mines n

The delicate lines and gossamer Dresden china lend themselves ef pieces for decoration and many its designs are of great variety, relief, in color and in gold. Great s nerve and accuracy of sight are the workmen, each of whom is first drilled in exercises of drawing, n a general study of forms and color he passes by gradual promotion fr est to the highest position in the wherein he has specialized. At t factory are to be found painters v is of a high order. The output inc statuettes, groups in figures and ca

SS. The clothing worn by civ- of to-day is the result of long ages it. It is supposed that the prim- of the human race, in the of the world's existence, wore no . What caused him first to attire garb of savagery—the plumage the pelts of beasts, and leaves, ls—has long been an interesting tudy and controversy. Modern nclined to accept the theory that dornment, the desire to appear her than the sense of modesty, the to ude and of the he oth- he for he ave he ce the der- ery the at vas his his all of ing- the om eg- vide with a natural garment to tection against the cold of winter of summer. Lacking the fur of beasts or the feathers of birds, he has learned how to provide for himself artificial coverings.

EGYPTIAN DRESS
Ancient water carrier on the Nile.

The story of the evolution of dress is the story of one of the world's mammoth industries; rather, a narrative of many allied industries. Beasts and plants innumerable have been utilized to clothe the human race. Fabrics of almost endless variety are now made from the hair of sheep, camels, alpacas and goats, and from the fibers of such plants as the cotton, flax, hemp and jute; an industrious little worm weaves a glossy thread from which is made lustrous and beautiful silk; the skin of various animals furnishes the leather that goes into the making of boots and shoes; the fur-bearers give their handsome coats that mankind may be protected from the cold. Smoke pouring from the chimneys of factories in every quarter of the civilized world and the whir of great machines, the most ingenious that can be conceived by the human mind, offer witness to the vastness of the problem of keeping mankind clothed. The reader may find the details of the story of clothing in the articles named at the end of this article.

AN ASSYRIAN KING

The Evolution of Dress. In early historic times both men and women wore a costume based on the skirt, now the characteristic garment of woman throughout the temperate regions. Trousers were a later invention. The rich and noble classes among the Egyptians,

Babylonians and Assyrians and other ancient peoples of the Orient adopted some form of long, loose robe, but the laboring people, who would be hampered by trailing skirts, had to be content with a short kilt which reached only to the knee.

About nine centuries before the birth of Christ the Assyrian kings added troops of horsemen to their armies, an innovation which made necessary a new form of dress for these soldiers. Accordingly, the skirt of the rider was split from the hem to the waist in front and back. This divided skirt in the course of a hundred years became a garment with two separate skirts, one for each leg; that is, a pair of trousers. The advantages of this costume were apparent to the laboring classes, who soon exchanged their kiltlike garment for the serviceable pantaloons.

Meanwhile, on the European shore of the Mediterranean Sea, a Greek civilization was developing. In early Greece, trousers never became popular; the earliest dress of the men consisted of a square piece of cloth, open on one side, and known as the *himation,* while in later times the *chiton,* a close-fitting, sleeveless shirt, reaching below the knees, was worn under the himation. The women wore a loose chiton of fine linen, reaching to the feet, and confined below the bust by a girdle. Sometimes they draped over the chiton a woolen shawl, called a *peplos.* The Romans, who imitated the Greeks in dress as well as in art, literature and mythology, had as their characteristic garment the *toga,* a sort of loose cloak under which was worn the *tunic* (see Toga; Tunic).

GREEK CHITON

As the Romans began their invasions northward it became necessary for their fighting *men* to adopt a costume appropriate for warfare, and so their soldiers wore, in addition to the tunic, tight-fitting trousers reaching to the calf of the leg. This garb was a copy of the dress worn by the Phoenicians, an Oriental people whose trading ships were found in the ports of all nations. When Julius Caesar invaded the island of Britain (England) in 55 B.C. he found the natives wearing a close, tuniclike coat and short pantaloons, in imitation of the Phoenician merchants who had visited their shores.

ANCIENT ROMAN DRESS
From left to right: Citizen, statesman, tribune.

The conquering Romans who came in contact with the Teutonic tribes of Central Europe found the men wearing trousers, and the women a long robe similar to the costume of the Greeks. From these two types—trousers and skirts—has come the standard dress of modern Europeans and Americans. Man's attire of the present time, however, the cutaway or sack coat for business wear, and the black long-tailed coat and low-cut vest for evening, is far removed from the rich and elaborate costumes worn in the Middle Ages and the early modern period. Oriental love of brilliant colors and ornamentation, first making its influence felt in Eastern Europe, spread later to the nations in the West, and by the beginning of the fifteenth century the costumes of both men and women had become so elaborate as to be burdensome.

During the Renaissance the characteristic dress of the man of fashion was the doublet, hose and cape. The stockings reached from waist to toe; the doublet, forerunner of the modern waistcoat, was a close-fitting garment, with or without sleeves, which reached from the neck to the waist; the cape, a relic of the ancient flowing robe, hung across the back and served chiefly for ornament. In England, dur-

ing the reign of Queen Elizabeth, both men and women of fashion wore a stiffly-starched collar reaching from shoulder to ear—the ruff of time-honored fame. A gentleman at the court of Queen Bess was a much-padded man: his sleeves were puffed out until no one could tell the shape of his arms; his hose were padded from thigh to knee; and his doublet was likewise generously stuffed. The whole suit was made of rich satins and velvets of many different colors. By the time of King Charles I court gentlemen were wearing short breeches, foppishly trimmed with fringe and ribbons of many hues.

DOUBLET, HOSE AND CAPE

Correct dress of the English nobleman of the Elizabethan period.

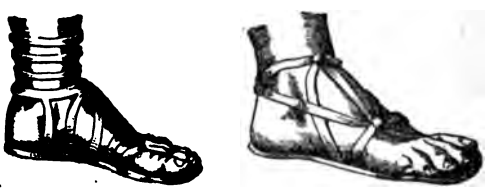
The modern tendency toward simplicity in men's dress dates from the close of the French Revolution, late in the eighteenth century. Men began to discard the powdered wig for their own hair, which they wore short and with its natural color, and the knee breeches became the modern trousers, reaching from waist to ankle. Women's dress has undergone striking changes in detail, but it has retained many of the decorative features now discarded by the men (see FASHION). The interest that the modern woman takes in athletics and out-of-door sports has helped to bring about wholesome changes in the matter of dress (see subhead below).

OTHER ELIZABETHAN COSTUMES

Woman in court costume and rich merchant of London.

It is characteristic of modern races that they wear many more garments than did the ancients. Stockings and underwear are almost wholly of modern origin, and it is believed that the custom of wearing hats was very little practiced by the nations of antiquity. Sandals were used generally in ancient times as a covering for the feet, but a form of footwear similar to the modern boot was known to the Egyptians, Greeks and Romans (see BOOTS AND SHOES).

Dress Reform. Woman's dress in modern times has called forth severe criticism because of features that violate the principles of hygiene. These criticisms have been directed chiefly against high heels that promote an unhealthful and unnatural carriage, tight stays that restrict the breathing capacity and injure the internal organs, and long skirts which collect dirt and disease-producing germs. In the United States, about the middle of the nineteenth century, a movement for a more rational dress for women began to take form, and a National Dress Association was organized to carry on the work of popularizing hygienic clothing. About two decades later a similar movement originated in England under the name of the Rational Dress Movement.



GREEK SANDALS

The most notable of the early American crusaders was Mrs. Amelia Bloomer, whose name is perpetuated in the loose Turkish trousers which she advocated as the most sensible dress for women. The "bloomer" costume is now worn chiefly in the gymnasium, though a few courageous women adopted it for use while riding the bicycle, when that vehicle was at the height of its popularity. The participation of women in out-of-door sports has been one of the most important factors in the hygienic dress movement. Girls who play tennis and golf must don clothing which permits free and

unhampered bodily movements, and they have helped to popularize comfortable shoes and short skirts.

There will always be those who choose to dress as the extremes of fashion dictate, regardless of the laws of hygiene. The rational dress movement, however, has accomplished much. Common sense in the matter of dress has ceased to be an oddity, and any woman may wear clothes that are comfortable and hygienic without being singled out for ridicule or pity. Even Dame Fashion has yielded to the outcry against the restricting stays, and it is inconceivable that there will ever be a return to the "hour-glass" shape that was but a few years ago the accepted ideal for a woman's figure. See FASHION. B.M.W.

Related Subjects. The following articles in these volumes contain much information as to various fabrics from which clothing is made and as to certain specific articles of dress:

Boots and Shoes	Felt	Plush
Broadcloth	Flannel	Ribbon
Brocade	Flax	Satin
Button	Fur and Fur Trade	Shoddy
Calico and Calico Printing	Gingham	Silk
Cambric	Glove	Stola
Chiffon	Gold Lace	Taffeta
Cloth	Hat	Tartan
Corduroy	Hemp	Tunic
Costume	Lace	Turban
Cotton	Leather	Tweeds
Crape	Linen	Velvet
Crinoline	Mohair	Wool
Dimity	Muslin	Worsted

DREW, JOHN (1853-), an American actor whose successes have been in light comedy rôles in plays gently ridiculing society. He is the son of the Irish comedian, John Drew, Sr., and the actress Louisa Drew, and made his first appearance in his mother's theater in Philadelphia. Three years later he took various parts in New York under Edwin Booth, Fanny Davenport and other stars. For years, beginning in 1875, he was the leading comedian in Daly's company, winning great popularity as Petruchio in *The Taming of the Shrew,* and as Charles Surface in *A School for Scandal.* After 1892 Mr. Drew was a star, appearing in *The Butterflies, A Marriage of Convenience, The Liars, Richard Carvel, The Tyranny of Tears, The Will, Rosemary, The Prodigal Husband* and other plays. For many years he was under the management of Charles Frohman, but in 1916, after the death of Mr. Frohman, he came under the management of John D. Williams. During the season of 1916-1917 he acted, with high distinction, the part of Major Pendennis in a dramatization of Thackeray's popular novel.

John Drew is the uncle of the well-known actors, Lionel, John and Ethel Barrymore (see BARRYMORE). His daughter, Louise Drew, is also a talented stage personage.

DREX'EL INSTITUTE OF ART, SCIENCE AND INDUSTRY, a school founded at Philadelphia, Pa., in 1891, by Anthony J. Drexel (see below) for the industrial training of men and women. The institution is divided into three departments, the engineering school, the school of domestic science and arts, and the secretarial school. Of these, the first is for men and the second for women; in the third both men and women are trained for positions as secretaries. There are special courses also in chemistry, architecture and English; both day and night classes are maintained, and the work is supplemented by free public lectures and concerts. The museum of Drexel Institute contains valuable examples of decorative art and collections of textiles. The entrance requirement is graduation from a high school or its equivalent, and the fees are very moderate. Nearly 3,000 are enrolled yearly in all departments. An important feature of the school is a splendid library of over 40,000 volumes.

Anthony Joseph Drexel (1826-1893), whose generous gift of over $2,000,000 made possible the establishment of Drexel Institute, was born in Philadelphia. At the age of twelve he entered the banking house of Drexel & Company, founded by his father, became a member of the firm eight years later, and in 1885 was nominally the head of that great banking system, with branches in New York and Paris. In 1864 he joined with his friend George W. Childs (which see) in the purchase of the Philadelphia *Public Ledger,* and was also associated with the latter in the founding of the Childs-Drexel Home for Union Printers at Colorado Springs, Colo. At his death his fortune was estimated to be about $30,000,000.

DREYFUS, *dra'fus,* ALFRED (1859-), a French soldier of Jewish descent, the victim of a racial and military plot which stirred the world. He was born in Alsace, entered the army in 1882, and showed such marked ability that he was appointed to the general staff in 1891. Three years later he was arrested on a charge of selling information to Germany. His trial resulted in his dismissal from the army, public degradation and transportation to Devil's Island, off the coast of French Guiana,

a French penal colony. In answer to popular demand the prisoner was retried in 1899. The feeling in the army against Jews was so bitter that the second trial was practically a mockery, and Dreyfus was again declared guilty, "with extenuating circumstances." The public was not satisfied with the evidence or the manner in which the trials had been conducted. In 1899, a few months after his second conviction, he was pardoned by President Loubet.

Emile Zola, the novelist, was among those who strongly supported his cause, and his complete vindication was obtained in 1906. It was conclusively proved that Dreyfus had been the victim of a conspiracy, and had been condemned on forged evidence. He was given the more advanced rank of major and enrolled in the Legion of Honor. While witnessing the removal of Zola's body, Dreyfus was wounded by a fanatic, who was liberated, however, on declaring that he had fired the shot only as a "demonstration." At the outbreak of the War of the Nations, in 1914, Major Dreyfus was placed in command of one of the forts protecting Paris.

DRIFT, in geology, is the name applied to deposits of rock and earth that were carried to their present position by ice and left there when the ice melted. Drift was formed during the Glacial Period. It varies in thickness, and contains whatever the glacier gathered on its surface during its course down the slope where it grounded. Large rocks in the form of boulders, differing in character from the rock in the locality, are occasionally found; these were brought to their present localities by a glacier. In some places the ground is covered with small boulders mingled with gravel, and in other places there are masses of broken rock, some of which may be deeply scratched. All these formations are drift. See GEOLOGY; GLACIAL PERIOD; GLACIER.

DROMEDARY, *drum'e da ri*, a lightly-built, fleet-footed, single-humped camel used for travel in various parts of India, Arabia and Africa. This enduring animal of the deserts can live on a very small amount of food and water, and requires only short periods of rest. It can travel at the rate of nine miles an hour for many hours, and can cover six hundred miles in five days. Its swinging trot, like the gait of a pacing horse, jolts less than the gait of an ordinary camel, but it is nevertheless hard on the rider. The general characteristics of the dromedary, or Arabian camel, are outlined in the article CAMEL.

DROPSY, *drop'si*, a disease whose name is the modern form of the word *hydropsy*, derived from the Greek *hydor*, meaning *water*. It is not applied to any particular malady, but to a symptom which accompanies several diseases. In dropsy there is an excess of fluid in the tissues, causing swelling. This fluid is derived from the blood. The presence of dropsy may be recognized by the small pit remaining after a finger is pressed upon the swollen part. It is sometimes necessary, when other remedies have failed, to remove the accumulation of fluid by means of a drainage tube inserted in the cavity or beneath the skin. This can be done without danger in most cases, under the direction of a skilled physician. Dropsy may be general, or it may be localized, having as its site the brain, the heart, etc. W.A.E.

DROWNING, *droun'ing*, death caused by suffocation in water or other liquid. From the earliest times until the beginning of the seventeenth century drowning was a common form of capital punishment in Great Britain and most European countries. Feudal lords who held power of life and death over their subjects or retainers were authorized to inflict the death penalty "by ditch or by gallows." In some cases the victim was given his choice of hanging or drowning. What was considered the more honorable death by drowning was usually chosen, a fact that may have given rise to the widespread belief that drowning presents the least unpleasant form of death. The death penalty was inflicted for trivial offenses in Great Britain until the commencement of the eighteenth century, but the practice of drowning criminals was abolished earlier. In Scotland a man was drowned, in 1611, for stealing a lamb. The early laws of Burgundy condemned a faithless wife to be smothered in mud. Drowning as a capital punishment is now practiced only in Mohammedan countries and in the Far East.

A person falling, or being thrown, into the water and unable to swim would probably lose consciousness in a minute, or in two minutes, at most. If the shock of immersion produces insensibility, death does not usually occur until after a longer interval than if the drowning person struggled violently—probably from two to five minutes after immersion. The popular belief that a drowning person must come to the surface three times before finally sinking is a fallacy. He may not rise at all, his doing so depending on circumstances, especially on the position of the arms during his struggles.

If they are held above the head, the body sinks deeper in the water. If they are held down at the sides, the body will probably rise to the

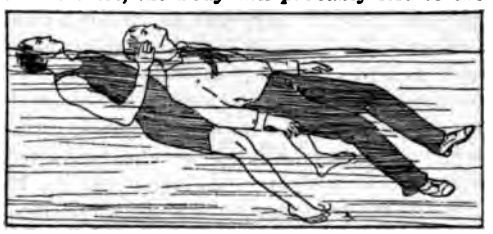


FIG. 1

surface. The tendency of all drowning persons to "clutch at a straw," or to take hold of anything within reach, only increases their difficulty and danger. The same habit often renders useless the efforts of rescuers.

Methods of Rescue. If the rescuer is in a boat his task is greatly simplified. The drowning person must be seized and lifted into the boat and conveyed as quickly as possible to the shore. If, however, the rescuer is swimming, he must be wary in his approach. If not prevented, the drowning person may grasp him round neck or waist and endanger the lives of both. What appear to be harsh measures are sometimes necessary to break the hold of a drowning person. Should the rescuer

FIG. 2

be grasped round the neck, he must place one hand against the back of the drowning person and with the other pinch his nostrils while forcing his head back. The drowning person will immediately let go his hold. If clutched round the body, the rescuer must quickly adopt strong measures by placing his knee against the stomach of the drowning person and then throwing the whole weight of his body backward. This will effect his release.

If the drowning person is conscious and sufficiently calm he should be grasped by the hand and turned on his back. The rescuer then swims on his back with the body of the drowning person above him, taking care to keep the man's face above water (Fig. 1). A struggling person should be firmly held by the arms, just above the elbows, the rescuer then turning him on his back (Fig. 2). Sometimes the struggles may be so violent that the rescuer has difficulty in securing either of the holds mentioned. He should then slip his hands under the armpits, raising the drowning person's arms to right angles with his body (Fig. 3). He is then helpless and the rescuer may swim with him to shore. When entering the water from a high bank or bridge to effect a rescue it is always advisable to drop in feet first unless the depth of the water is accurately known.

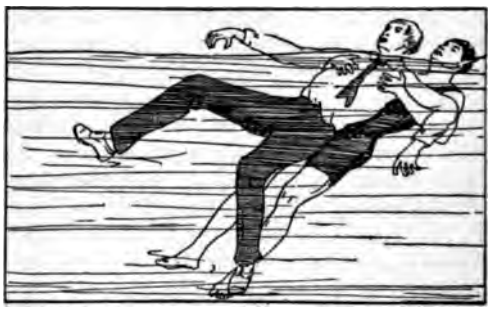


FIG. 3

First Aid Measures. It is an undoubted fact that many lives are lost through ignorance on the part of the rescuers as to the best method to adopt when the drowning person has been safely removed from the water. The simplest and most efficient method of revival is as follows: Place the body face downward on the ground with the arms extended as shown in the illustration (Fig. 4). The rescuer should then kneel with one knee on either side of the body, placing his two hands flat on the lower part of the back and pressing on the lowest ribs. The weight of his body should then be thrown forward, pressing the ribs upward. This

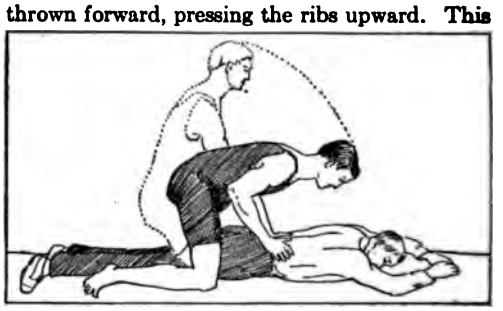


FIG. 4

will drive air and water out of the patient's lungs.

The rescuer then slowly raises his body, releasing the pressure. These operations should

be repeated thirteen or fourteen times a minute and should be continued for at least half an hour, if not more quickly successful. If assistance is available, hot water bottles and hot flannels should be applied to feet and body, but the artificial pressure in and release of the lungs this must be maintained without any attempt to change clothes or give any medicine or stimulants until the patient has commenced to breathe naturally. By this method persons have been revived when it seemed impossible that there should be even a lingering spark of life.

Though some such mechanical device as the pulmotor which we have been used to advantage in reviving unconscious persons, the weak point in depending upon such apparatus lies in the fact that it is not usually at hand. If more than ten minutes elapse after breathing stops, nothing can usually be done to revive the victim. A well-known authority says: "Universal training in the manual method will accomplish more for resuscitation than is possible by providing any amount of apparatus."

F. P. A.

DRUG'GIST, or PHARMACIST, *far'ma-sist.* a person who has made a study of drugs and medicines, taken an examination and received a license to prepare and sell medicines and fill doctors' prescriptions. In the United States and Canada, *druggist, pharmacist* and *apothecary* have the same popular meaning, but the term *druggist* is in most common use, just as *drug store* is applied more often than *pharmacy* or *apothecary shop* to the place where medicines are prepared and sold and prescriptions are filled. *Pharmacy,* from a Greek word meaning *the use of medicines,* is the science and art of preparing and preserving drugs and medicines. Correctly speaking, a pharmacy is a shop where only drugs are compounded and which does not offer for sale the usual array of articles displayed in drug stores.

Schools of pharmacy have existed in the United States since 1821, and the leading universities have departments for teaching this branch of medicine, but each state makes its own laws as to the qualifications its druggists must possess. All of the leading universities of Canada have schools of pharmacy connected with them, and the Ontario College of Pharmacy is an important institution of Toronto.

DRUIDS, *droo'idz.* Long ago when the Britons lived in England they had priests who were called druids. These druids lived in huts or caverns in the forest and were thought to be very wise. There were no temples in which the people could worship, but at noon or at midnight they went to a grove of oaks, where the Deity was supposed to be present, and offered their prayers. The druids worshiped the same gods as the Greeks and Romans, but called them by different names, and they also believed in an after-life.

The druids were held in very great respect and honor, because they were so wise. They taught the children and tried to keep peace among the people, who would do almost anything a druid would tell them to do. Many years were spent in preparation to be a druid, and only sons of illustrious families were allowed to enter the schools for training. They were sworn to secrecy, as they were supposed to possess a mysterious science, but their knowledge was mainly about the stars and simple medicines. Besides acting as teachers, they were prophets and judges, so people often called on them to settle public or private disputes.

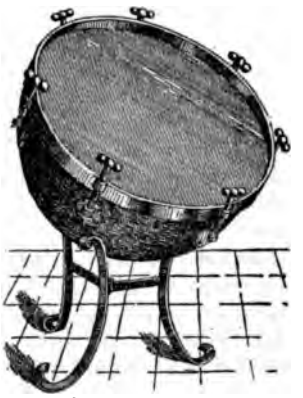
DRUM. There are scholars who say that men talked in poetry before they learned to speak in prose, but whether this be true or not, it is certain that with primitive man rhythm is an instinct. That is why the drum is the oldest of musical instruments. Go anywhere among races still in their childhood and one is almost certain to find the tom-tom marking the beat of the native dances, just as the more intricately-fashioned drum emphasizes the rhythm in the ballrooms of the civilized world.

Bass Drum, or **Turkish Drum,** formerly known as *long drum,* is the big, heavy instrument whose deep full tone or dull thud marks the climaxes in orchestral music and emphasizes the rhythm in music of large bands and orchestras. It has a short, hollow cylinder of wide diameter, both ends being covered with tightly stretched skin or vellum, kept in place by hoops. These can be adjusted by means of leather braces which can be slipped up or down on zig-zag cords that pass around the cylinder and connect the hoops. Adjustment by means of these braces, or by various rods and screws, will vary the pitch of the drum. The bass drum is played by beating on one or both sides with a stick having a large knob covered with cork, sponge or felt.

Snare Drum, or **Side Drum,** is the drum of resonant tone, and the drum which plays such an important part in military life. This little

instrument, with the rattling, rumbling voice, consists of a hollow brass or wooden cylinder and is constructed like the bass drum, excepting that catgut strings, or *snares,* are stretched across the lower end, or *head,* to produce the brilliancy of sound lacking in drums without snares. This drum is sometimes worn at the side; it is played with two slender, wooden sticks. Skilful playing of the snare drum is really difficult and very interesting.

Kettledrum, a hollow hemisphere of brass or copper, the end of which is covered with vellum, which is adjusted by means of screws. It is played with a felt- or leather-covered mallet. The kettledrums are generally used in pairs in orchestras, one being tuned to the keynote, and the other to a higher key. Sometimes three are used. They are the only drums which can be accurately tuned.



KETTLEDRUM

Beethoven was the first to recognize the possibilities of a drum in orchestral performances. C.H.H.

DRUM'MOND, Sir George Gordon (1772-1854), a British soldier, second in command of the British forces in America from 1813 to 1815. He was born in Quebec, entered the British army when a boy of seventeen, and distinguished himself in Egypt and during the Napoleonic wars in Europe. From 1808 to 1811 he was on duty in Canada, and in 1813 was again sent there as second in command to Sir George Prevost. He personally planned the successful attacks on Fort Niagara and Oswego, and was in command of the British forces at the Battle of Lundy's Lane, occurring on July 25, 1814. After the recall of Sir George Prevost, Drummond remained in Canada as commander-in-chief until 1816.

DRUMMOND, Henry (1851-1897), a well-known Scottish evangelist, scientist and author. His fame rests upon his attempt to explain the theory of evolution in connection with Christianity in his two famous books, *Natural Law in the Spiritual World* and *The Ascent of Man.* He was born at Stirling and after graduating from the University of Edinburgh in 1870 began to study for the ministry at New College, Edinburgh. Stirred by the evangelistic work of the Americans, Moody and Sankey, he began mission work, and the religious movement which he started spread throughout England and even to America and Australia. In 1877 he was appointed lecturer on natural science in the Free Church College, Glasgow; in 1884 he became professor of theology there, and his religious work among the students became a great power.

He traveled extensively, making three trips to the United States and Canada and one to South Africa in the interest of science. On his visits to America he lectured on both religious and scientific subjects. *Travel Sketches* and *Tropical Africa* were written after these trips. His first book, *Natural Law in the Spiritual World,* created a decided sensation, requiring twenty-nine editions in ten years. Perhaps his greatest work was his short analysis of the thirteenth chapter of *I Corinthians,* called *The Greatest Thing in the World.*

DRUMMOND, William Henry (1854-1907), a Canadian physician and poet, whose dialect poems about the *habitants* won for him a unique place in Canadian literature. Drummond was born in County Leitrim, Ireland, but when still a boy he came to Canada. He attended high school and McGill University at Montreal, and in 1844 was graduated in medicine from the University of Bishop's College, Lennoxville, Quebec. He was fond of sports and was naturally athletic, being an expert shot-putter and hammer-thrower, a skilful angler and a good shot. With this equipment, in addition to his medical knowledge, it was natural that he would have a sympathetic insight into the lives of people like the *habitants,* the lumbermen and fishermen, the Indians and half-breeds, who were steeped in the lore of forest and river.

WILLIAM HENRY DRUMMOND

Dr. Drummond began his professional career in a community made up chiefly of French-Canadian *habitants* and half-breeds, with a considerable sprinkling of English and Scotch-Irish, and even in later years, when he was practicing in Montreal and was a distinguished

professor of medical jurisprudence in the University of Bishop's College, he never lost his sympathy for these people. He put their stories and their lives into verse, in a broken English which greatly heightens the humor and the pathos. Among the best of these poems are *The Habitant; The Last Portage; The Wreck of the Julie Plante; Leetle Bateese; Johnnie Courteau,* and *The Voyageur.*

Several volumes of his poems were issued during Drummond's life, and in 1912 they were edited by Louis Fréchette. G.H.L.

DRUM'MONDVILLE, the county town of Drummond County, Quebec, sixty-two miles northeast of Montreal and twenty-eight miles northeast of Saint Hyacinthe, on the Saint Francis River and on the Canadian Pacific and Intercolonial railways. Drummondville is a manufacturing center, its largest establishment being a chemical works, with 800 employees. Other large establishments make boots and shoes, steel and structural iron, foundry products, lumber and various wood products, including sashes, doors, matches and carriages. The Saint Francis River is not navigable, but supplies water power at Lord's Falls, near the town. Population in 1911, 1,725; in 1916, estimated 2,600.

DRYADS, *dri'adz,* or **HAMADRYADS,** *ham' a dri adz,* in classical mythology, the wood nymphs who danced with the god Pan. It was believed that with each tree a dryad came into existence and that she, too, perished when the tree died. Purposely to destroy a tree, the house of a dryad, was considered an impious act and was punished accordingly. These graceful nymphs of the woodlands at times assumed the forms of followers of the hunt, peasant girls or shepherdesses. See NYMPHS.

DRYDEN, *dri'den,* JOHN (1631-1700), a distinguished English poet, dramatist and critic, the greatest writer of the last two decades of the seventeenth century. He was the first poet of the new school whose typical representative was Alexander Pope, and he was also one of the earliest masters of English prose. Dryden, the third son of a baronet, was born in Aldwinkle, a village of Northamptonshire. He studied at Westminster School and at Trinity College, Cambridge, receiving his degree of B. A. at the latter institution in 1654. In 1658, the year after his removal to London, he published his first important poem, *Heroic Stanzas to the Memory of Oliver Cromwell.*

Though a loyal adherent of Cromwell, Dryden shared the nation's joy over the restoration of Charles II (1660), celebrating that historical event in two dignified poems entitled *Astraea Redux* ("The Return of the Heaven-born") and *Panegyric on the Coronation.* In 1663 the performance of the *Wild Gallant,* at the King's Theater, proclaimed him a dramatist and marked the beginning of a series of tragedies and comedies that covered the next twenty years of his literary career. Of these, the best is *All for Love,* a tragedy written in blank verse and founded on Shakespeare's *Antony and Cleopatra.* His other tragedies, which are of the type known as the "heroic" play, are written in a form of verse in which the lines rhyme in couplets. In the heroic play there is no attempt to portray real life. The themes are lofty, almost operatic in character, and the work has something of the effect of an epic poem. Of this form of dramatic writing Dryden was the great master. His plays, however, reflect the low moral tone of his age (see DRAMA).

JOHN DRYDEN

In 1667 he produced the best of his earlier poems, *Annus Mirabilis* ("The Wonderful Year"), his theme being the successful war with the Dutch and the great London fire of 1666. In 1670 his talents received royal recognition in his appointment as poet laureate (which see). Though he was then in the high tide of a successful literary career, his dramas were held up to scorn in a play called *The Rehearsal,* written in 1671 by the Duke of Buckingham. Dryden obtained his revenge when he wrote his celebrated political satire in verse, *Absalom and Achitophel* (1681). In this he struck hard at all of his enemies, including the Duke, and ably defended Charles II against the Whigs. In 1682 he published *The Medall,* a satire on the notorious Earl of Shaftesbury; *MacFlecknoe,* a scathing attack on a minor contemporary poet, Thomas Shadwell, and the second part of *Absalom and Achitophel.* In the same year appeared his *Religio Laici,* a poem defending the doctrines of the Church of England.

Dryden's conversion to the Roman Catholic

faith was made known in 1687 by the publication of his *Hind and Panther,* a long poem giving a supposed dialogue between a milk-white Hind, typifying the Catholic Church, and a spotted Panther, representing the Church of England. On the accession of the Protestant monarchs, William and Mary, he lost his office of poet laureate, and the last years of his career were devoted mainly to translations or renderings of Vergil, Ovid, Boccaccio and Chaucer. In 1687 he wrote the first of his *Songs for Saint Cecilia's Day,* and in 1697 the second of the lyrics was published as an ode on *Alexander's Feast,* the concluding lines of which are:

> At last divine Cecilia came,
> Inventress of the vocal frame;
> The sweet enthusiast, from her sacred store,
> Enlarged the former narrow bounds,
> And added length to solemn sounds,
> With Nature's mother-wit, and arts unknown before.
> Let old Timotheus yield the prize,
> Or both divide the crown;
> He raised a mortal to the skies,
> She drew an angel down.

Dryden's greatness as a poet rests chiefly on his mastery of verse form. He lacked the fire and imaginative power of the writers of the Shakespearean era, and his fame and popularity as a poet suffered a permanent decline when the splendid outburst of the Romantic Period revealed the possibilities of the poetry of inspiration and imagination (see ROMANTICISM; WORDSWORTH, WILLIAM). As a critic, however, and as the creator of an easy, graceful and correct prose style, his fame is secure, and his *Essay on Dramatic Poesy,* setting forth his views on the rhymed couplet in tragedy, is a masterpiece of criticism. B.M.W.

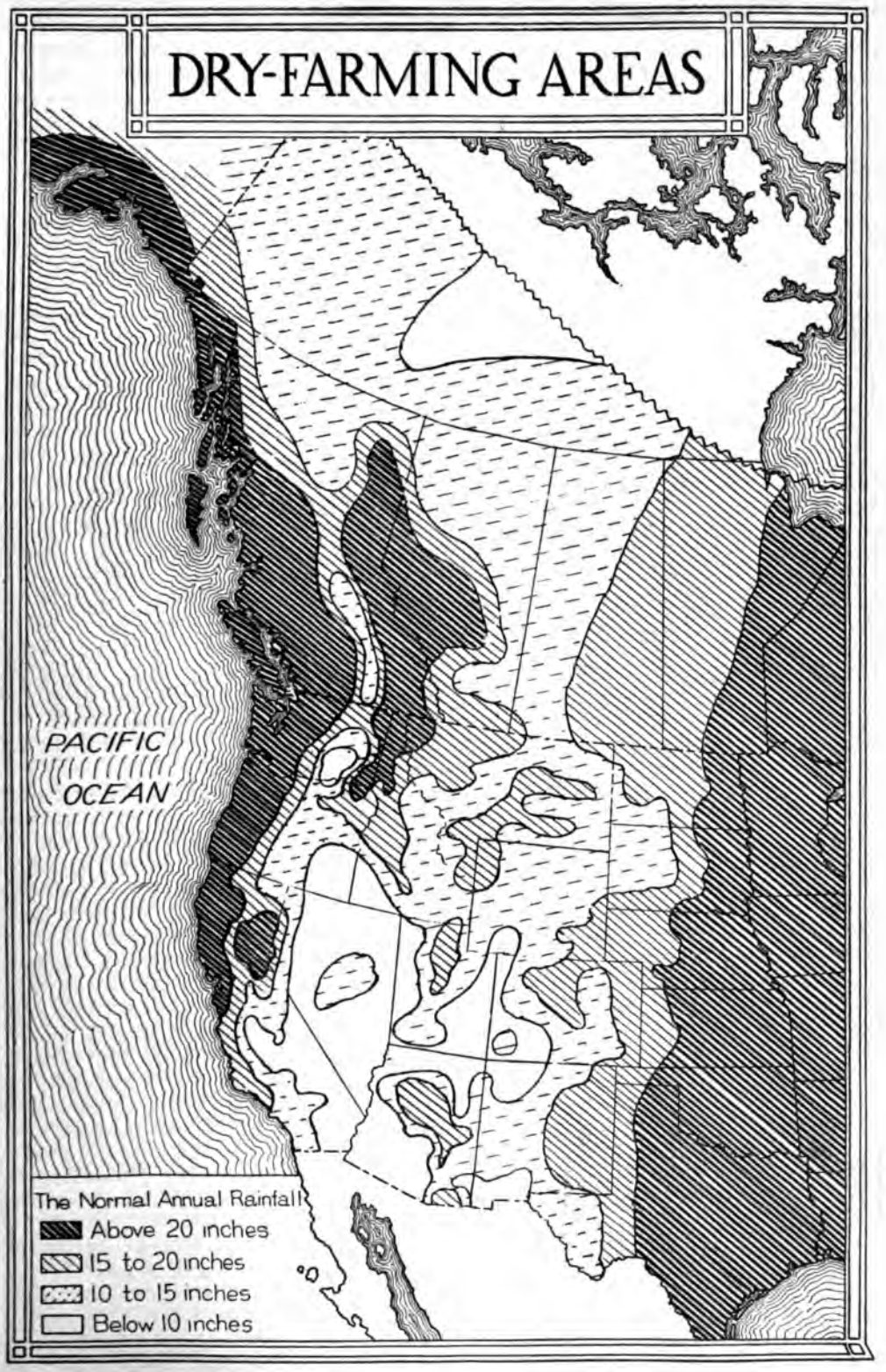
DRY FARMING, or crop raising without irrigation on lands which receive little rainfall, has within recent years become so effective that hundreds of thousands of acres once considered half-desert are now fertile farms. In general, if less than twenty inches of rain fall on a piece of land within a year, dry-farming methods are necessary; if less than ten inches, irrigation alone makes the tract valuable.

The success of dry farming depends upon storing in the ground the moisture which it receives. The methods chosen vary with the conditions in each locality, such as the total amount of rain, the seasons in which it falls, its frequency and the rapidity of evaporation and of drainage. Thus on the Canadian prairies, where most of the moisture falls in summer, dry farming is conducted differently than in Oregon, which has winter rain. So, too, when rain falls in frequent light showers it has a different effect from rain coming in violent storms. Besides, the variations in evaporation are so great that fifteen inches of rainfall in Saskatchewan are more than the equivalent of twenty-one inches in Texas.

Canadian Methods. Farmers who settle upon the prairies of Manitoba, Saskatchewan and Alberta from Eastern Canada or other regions of plentiful rain frequently insist upon treating their land as they had done in their older homes. They usually fail. But those who follow the dry-farming instructions which the Dominion experiment stations have given since 1888 raise larger crops of wheat than are known in the United States, and have success with other crops.

Breaking and *backsetting* and *summer-fallowing* are the processes recommended. If a farmer raises a crop on new land the first year, he will fail to secure a crop the next year, because he will have exhausted the moisture in the soil. So the best plan is to seed only a part of the farm. On the rest the prairie sod is plowed, or *broken,* as shallowly as possible, before the rains of early summer, which will then rot the sod. Early in August the sod is *backset,* or turned back to its original place, with two or three inches of fresh soil over it. It is then broken into powder with a disk-harrow, an implement described in the article HARROW. The moisture preserved in soil prepared in this fashion will be sufficient for a crop the next year. When this is cut, a high *stubble* (the stumps of the grain stalks) should be left to hold the snow, which will melt in the spring and give the moisture necessary to germinate the seed. At seeding time the stubble may be plowed under or burned. After the second crop the land should be *summer-fallowed,* that is, left idle after being plowed seven or eight inches deep in time to catch the summer rains. Otherwise, except in a year of unusual rainfall, the next crop will suffer from drought. It is especially important in dry farming to keep down the weeds, for they rob the soil of water.

In the United States. Interest in scientific dry farming in the United States commenced just before the end of the last century, when several years of slight rainfall had caused immense crop loss in the West. Summer-fallowing, where it is found helpful, is usually practiced in alternate years instead of every third


DRY-FARMING AREAS
PACIFIC
OCEAN
The Normal Annual Rainfall
Above 20 inches
15 to 20 inches
10 to 15 inches
Below 10 inches

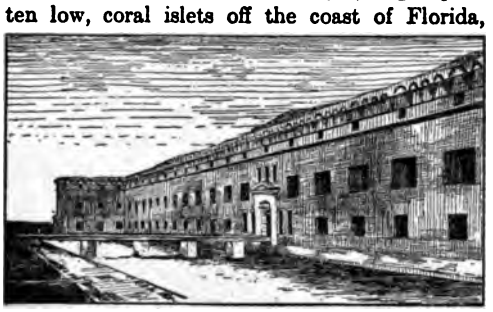
year, as in Canada, and is especially suitable to regions of winter rain. In Utah and a large part of the Great Basin, where rain falls in both spring and winter, wheat is sown in the fall and remains in the ground through the winter, sprouting early and maturing before the dry winds of the summer. The resulting crop is known as *winter wheat*. On the Great Plains, on the other hand, the rain comes in the summer in showers so light that the moisture would evaporate before it could be absorbed by summer fallow. In this case the best method seems to be to plow deep before the spring sowing, and to harrow the ground after the grain is high enough to shade the ground and prevent evaporation.

Further progress has been made in agriculture in the semi-arid regions by a study of the comparative resistance of different crops to drought. Besides wheat, success is found with rye, oats, flax, barley, corn, potatoes, sorghum, alfalfa, many types of peas and beans, and, in the Southwest, with dates and olives. Though the methods for each crop are different from that for the wheat farming described above, the principles are the same.

Dry-Farming Congresses. Since 1907 there has been an annual convention of American and Canadian farmers in the West, the object of which is to advance the science of dry farming. Prizes are given each year for the best exhibits of agricultural products raised by dry-farming methods. The winners for wheat and oats are most often from Saskatchewan or Alberta. C.H.H.

Consult Shaw's *Dry Land Farming;* Widtsoe's *Dry Farming: A System of Agriculture for Countries Under a Low Rainfall.*

DRY TORTUGAS, *tawr too'gas,* a group of ten low, coral islets off the coast of Florida,



ON DRY TORTUGAS
Old Spanish fort, the most southerly building on United States territory.

almost directly west of Key West, set aside by the United States government as a permanent reservation for wild birds. They are situated in the Gulf of Mexico, about 120 miles southwest of the southern extremity of Florida, and are politically attached to Monroe County, of that state. Fort Jefferson, one of the islands, contains a fort which was used as a penal station during the War of Secession. On Loggerhead Key, the largest of the group, is a lighthouse, and in 1904 the Carnegie Institution established there a laboratory for the study of marine biology. See BIRD, subtitle *Government Protection of Birds.*

DU BARRY, *dü ba re',* MARIE JEANNE BÉCU, Countess (1743-1793), the charming, extravagant mistress of Louis XV who succeeded Madame de Pompadour. She was the daughter of a poor woman, but her beauty won her friends, through one of whom she was placed in a convent, where she remained about eight years. She then held positions as lady's maid and milliner, finally becoming the mistress of Comte Jean du Barry. Presiding over her lover's gaming rooms, she met King Louis XV, who became infatuated with her, and about 1769 he married her to the brother of Comte Jean du Barry, so that she might be brought to court. Until the death of Louis she was the real ruler of the country, for the most important policies of the government were decided by her. Her quick wit, gracious manners and alluring beauty brought her admirers, but she had many enemies as well. After the death of Louis XV she was banished from court, and during the Revolution, through the influence of Robespierre, she was tried and executed for having wasted the public wealth, for conspiracy against the republic and for mourning for King Louis.

MADAME DU BARRY

David Belasco's successful production *Du Barry,* in which Mrs. Leslie Carter starred, was featured in moving pictures.

DUB'LIN, the capital and ancient seat of the government of Ireland, situated at the mouth of the River Liffey. The river divides the city into two almost equal parts and is crossed by twelve bridges, the finest of which is a magnificent structure named after the

patriot O'Connell. The older portion of the city has narrow, dirty streets, but the more modern parts are well built and contain many fine thoroughfares. Sackville Street is one of the broadest streets in the British Isles, with a width of 120 feet. The banks of the Liffey are lined with well-built granite docks for a distance of two miles from the sea, and ships drawing twenty-three feet of water can enter at low water.

The castle, the official residence of the viceroy, is an imposing building, and there are many fine modern buildings in the business section of the city. The old home of the Irish Parliament is now the Bank of Ireland, but will in all probability again become the seat of an Irish legislature (see HOME RULE). Dublin is noted for its squares, and in Phoenix Park possesses one of the most beautiful parks in Europe. Although not a manufacturing center, the city has important industries and carries on an extensive trade. Stout and whiskey are the principal products, but a large quantity of the celebrated Irish poplin is manufactured. Swift, Steele and Sheridan were all natives of Dublin, and were buried in the beautiful cemetery of Glasnevin, on the banks of the Liffey. There also lie the remains of Charles Parnell, for many years leader of the Irish political party in the British Parliament.

Dublin is a city of great age; it was a place of importance before the Christian Era. The Danes captured it in the ninth century and held it until driven out by Henry II (1133-1189). Population in 1911, 403,030.

Dublin University, the foremost, and for centuries the only, university in Ireland. It is generally known as Trinity College, being both college and university. First established in 1320, it was abandoned for want of support. In 1591 it was incorporated as the "College of the Holy and Undivided Trinity." Entrance to its classes is obtained by examination, and degrees are conferred on all graduate students.

DU BOIS, *doo bois'*, PA., a borough in Clearfield County, west of the center of the state, 129 miles northeast of Pittsburgh. It is on the Buffalo & Susquehanna, the Buffalo, Rochester & Pittsburgh and the New York Central railroads, and is also served by electric interurban lines. Coal mining is the leading industry, and the borough also contains glass and clay works, blast furnaces, refining works, extensive railroad repair and construction shops, a foundry, a tannery and an ice-cream factory. Du Bois was settled in 1873 and was incorporated as a borough in 1881. It has a general hospital. In 1910 the population was 12,623; in 1916 it was 14,665. The area is about three square miles.

DUBUQUE, *doo buque'*, IOWA, popularly called the *Key City*, the oldest city of the state and the county seat of Dubuque County, is situated in the northeastern part of the state, on the Mississippi River. Chicago is 172 miles slightly southeast, Des Moines, the state capital, is 206 miles southwest, Saint Paul is 252 miles north and Omaha is 337 miles southwest. By water, Clinton is eighty miles south. Transportation is provided by the Illinois Central, constructed to the city in 1859; the Chicago, Milwaukee & Saint Paul, built to this point in 1875; the Chicago Great Western (1884), and the Chicago, Burlington & Quincy (1886). The city is also a port of call for packet lines operating between Saint Louis and Saint Paul, but water transportation is not important. The river is spanned by three bridges, the north bridge touching the shores of Wisconsin. The population increased from 38,540 in 1910 to 39,873 in 1916.

Dubuque has a picturesque location within a crescent of bluffs about 300 feet above the river; at the foot of these bluffs lies the business district. Several cable roads and a winding street railway lead to the upper section of the city and to Eagle Point Park, a family resort of 120 acres at the northern end of the crescent.

Industry and Commerce. The city is the center of the lead and zinc region that extends into Iowa, Wisconsin and Illinois, and it contains extensive zinc works. Of its 175 industrial establishments the most noted is a manufactory where steel-hulled vessels, including government torpedoes, revenue cutters, transports, barges and many giant steamers of inland waterways, are built. Two of the largest sash and door factories in the world are located here, and another immense plant is devoted to the manufacture of cabinets. There are in addition important manufactories of agricultural implements, boots, shoes, lumber, wagons, carriages, flour, foundry products, malt liquors and pearl buttons; the machine shops of the Chicago, Milwaukee & Saint Paul Railway also operate here.

Institutions and Buildings. Since the population is largely Roman Catholic, the city has many Roman Catholic institutions of learning. About half the primary schools of the city are parochial schools. Dubuque College (includ-

ing Loras Hall), Saint Joseph's College, the Visitation Convent, Wartburg Seminary (Lutheran) and the Iowa Institute of Science and Arts are among the schools for higher education. Mount Carmel (for girls) occupies a height overlooking the Mississippi, and with its beautiful view and grounds is one of the show places of the city. Benevolent institutions include Mercy Hospital, Mercy Hospital for the Insane, Finley Hospital and the Y. W. C. A. Home. Dubuque is also the see of a Roman Catholic archbishop, and one of the two Trappist monasteries in the United States is in the vicinity. Besides the Federal building, constructed of Bedford stone about 1866, the city's notable buildings are the Carnegie-Stout Public Library, which cost $100,000, a $125,000 Elks' Home, completed in 1915, and the Hotel Julien Dubuque, also completed in 1915.

History. As early as 1788 Julien Dubuque, a French-Canadian trapper and miner, voyaged down the Mississippi River and discovered what became *The Mines of Spain,* under his grant from the Spanish governor of Louisiana. With several others he settled there for the purpose of mining lead. Upon his death (1810) the Indians buried Dubuque on a bluff overlooking the mines, and the legend is that fires were kept burning over his grave until they departed from the country after the Black Hawk War (1832). A monument of native stone erected by the Early Settlers' Association marks the grave. The settlement was abandoned after the death of Dubuque and was not again occupied until 1833. This was the first permanent settlement in Iowa. The city was incorporated in 1844.

DUCAT, *duk'at,* a coin first issued by Roger II of Sicily, Duke of Apulia, in the eleventh century, which later became common in all countries of Southern Europe. It was issued both in gold and silver and varied considerably in value. The silver coin was worth at various times the present equivalent of 75 cents to $1.10, while the gold coin was valued at $1.46, and sometimes as much as $2.32. The ducat of the Venetians, referred to by Shakespeare in *The Merchant of Venice,* had a standard value of $1.46. So Antonio's debt of 3,000 ducats to Shylock was close to $4,500, according to present standards. Austria still retains the ducat, valued at $2.285, but it is used more in foreign than in domestic trade.

DUCK, a web-footed water bird found both domesticated and wild throughout the world. Wild ducks are economically valuable as game birds, for the flesh of many species is highly esteemed as food. For that reason they are national assets, and as such are quite generally protected by laws. Even so, however, the ranks of wild ducks are being depleted yearly, and in some locations where myriads once bred and fed but a few hundreds now are seen. Only through careful conservation and coöperation of human beings can these birds keep their place in the scheme of the universe. Wastefully decreasing their numbers not only removes a valuable source of food and makes them a luxury for even the wealthiest, but also [illegible] that interesting and healthful outdoor [illegible] hunting, almost a thing of bygone [illegible]

racteristics. Ducks have broad, flat bills, tooth-edged, for holding or straining food. Their heads are large; the necks are rather long and slender, but much shorter than the necks of geese or swans, to which they are related. Their bodies are short and thick, covered with close, compact feathers, under which lies a thick, soft down. The feathers of many species are beautifully colored; all species keep their feathers well oiled from two large glands just above the tail, and so they are made waterproof. Ducks' legs are short, and are placed so far back it is difficult for them to walk; because of this their movements on land have been called a "waddle." Ducks are fine swimmers and wonderful divers. Their food consists chiefly of insects, snails, frogs and fish, as well as grains, grasses and other vegetable matter.

Mother ducks lay from six to sixteen eggs, in a warm nest made of leaves, hay and other

HOME OF THE MALLARD. The bird above was "shot" by the camera man as he rose from the water. Below, a scene during autumn migration.

materials, lined with down from their breasts. The nests are placed usually on the ground near the water, sometimes in a bushy field farther back and in case of some species in a hollow tree. All the cares of the family fall upon the mother, although the father duck is a devoted lover. For four weeks she must remain on the nest almost continuously. Then, after the downy ducklings break through the shell, they are led by the mother to the water as soon as they can travel. For six weeks or more after hatching they are unable to fly, and she must guard them carefully, for snapping turtles, water-rats, snakes, pike and various hawks are dreaded enemies.

Wild Ducks. These birds can be divided into two classes, the *sea ducks,* which obtain their food by diving to great depths, and the *river ducks,* which breed in shallow water.

Sea Ducks. Species belonging to this class live not only in seas, but are also found inland. Unlike river ducks, they have a webbed hind toe, appear in large flocks and feed by day. Sea ducks are usually not so good to eat as river ducks, for most species feed on fish, lizards and tadpoles, which makes their flesh coarse and not agreeably flavored. The best-known pecies of sea duck, however, the *canvasback,* highly valued for the table. It feeds chiefly the bulbs of eelgrass, known as wild celery. is that food which makes its flesh tender and es to it the exceptional flavor which makes so well liked.

The canvasback breeds in the Northern ited States and Southern Canada. In Octo- large flocks migrate southward as far as tral Mexico and the Gulf coast. About sapeake Bay they are especially numer- at that time of year, and when large wedge- ed masses of continually-flapping wings are the sportsmen begin to plan days of duck ing. When the birds reach a chosen spot esting they wheel round and round before ng, looking first for lurking danger in the s.

er sea ducks are the eider, well known alued for the down which makes our pil- o comfortable and our coverlets so soft rm (see EIDER DUCK); the *redhead,* much e canvasback, and by many as highly d; the *greater* and *lesser scaups,* which bays and river mouths, preferring salt ish water, but which are also good ls; the finely-flavored *ring-necked* e edible *golden-eyes,* the rankly-fla- *squaws* and *buffleheads,* the gay-plu- maged *harlequins,* the dark-colored, ined *scoters* and the *ruddy* ducks, which are in esting for their queer tails of stiff, poin feathers, bare to the base. The latter are eas taken, and large numbers find their way to t markets.

River Ducks. Perhaps the most importa of all ducks is a species of river duck, the *ma lard,* for from it many domestic varieties hav been derived. The male mallard, or drake, ha deep-green plumage on the head and neck. A white collar separates the green from the dark-chestnut breast. The rest of the body is gray-ish-brown above, whitish below, and the four middle feathers of the tail are recurved. Some tame ducks have nearly the same plumage as this handsome wild one. Others vary greatly, being generally duller or pure white. In flocks of about fifty, mallards and other river ducks are found feeding on small grassy ponds, or on lakes or rivers, where wild rice, eelgrass and rushes are thick. In duck-hunting seasons painted wooden ducks or live ducks are anchored in the water by sportsmen to serve as decoys. These lure other ducks within range of the gunners' hiding places among the rushes (see DECOY).

The excellently-flavored mallards are found principally throughout the central parts of America, but a species just as desirable, the *black,* or *dusky,* duck, is found on the Atlantic coast. Other species of river ducks are the beautiful gray *gadwall,* which is comparatively rare; the handsomely-colored *baldpate,* as good to eat as the canvasback, for it eats the same food—in fact steals it from them; the fine table ducks, the *shovellers,* which have spoon-shaped bills; the delicious long-tailed *pintail,* and the little *green-winged, blue-winged* and *cinnamon* teals. The teals weigh but little over a pound, but are highly prized for their flesh and are regarded as great delicacies. They are easily approached, but are very rapid fliers, therefore difficult to hit on the wing. Unlike other species of duck, such as the mallards and canvasbacks, the teals drop suddenly down to the water and do not wheel about looking for danger. The most beautiful of all American ducks is probably the many-colored *wood duck,* whose numbers decreased so rapidly that the Federal migratory bird law provided for a closed season on them until 1918 (see GAME, subhead *Game Laws*).

Domestic Ducks. Some of the favorite domestic ducks in America are the white Peking, introduced from China; the large, white, excel-

lent Aylesbury, from England; the colored Rouen, from France; the huge, colored Muscovy, from South America.

Value. Duck raising has developed into a profitable industry, and American poultrymen realize about $7,000,000 a year from the eggs, feathers and dressed meat of ducks. E.T.S.

DUCK-BILLED PLATYPUS, *plat'i pus,* a peculiar egg-laying water mammal, in habit and appearance a seeming mixture of several animals. It lives in quiet streams of Australia, Tasmania and New Guinea, where large colonies usually live in pairs, in burrows in the banks of streams. The burrows are furnished with two openings, one above water and one below, and sometimes they extend a long distance into the bank.

DUCK-BILLED PLATYPUS

A duckbill's body is rather slender, about twenty inches long and covered with brown, water-shedding fur. Its head is small, with bright eyes, and instead of a nose it has a horny bill resembling that of a duck, except that the nostrils are at the extreme end; so, in order to breathe, the animal need only poke its bill out of water. There are no external ears, but through internal ears the hearing is very keen. The legs are short and the feet have five clawed toes each, the forefeet being webbed beyond the claws to aid in swimming, the hind feet being webbed but to the base of the claws. The male has a sharp horny spur on the heels, which he uses as a means of defense. Duckbills are very clumsy on land, but they are fine swimmers and divers, getting their food of snails, shellfish, insects and worms under water.

The female lays one or more soft-shelled eggs, which she hatches soon after laying. The young, which are born blind and naked, are then fed and cared for in much the same way as the young of other mammals. Savages hunt duckbills as food and for their skins.

DUCTILITY, *duk til' i ti,* that quality in certain substances, especially metals, by which they can easily be drawn out into thin thread or wire without breaking. Gold is the most ductile of metals, followed in order by silver, platinum, iron, copper, aluminum, zinc, tin, lead and nickel. From one grain of gold a thread 500 feet in length may be drawn. Platinum may be drawn out into a thread only 1-30,000 part of an inch in thickness. To obtain this, however, the platinum must be covered with silver, both metals being drawn out together. The silver is afterwards dissolved in nitric acid, which leaves the platinum thread intact. Glass is the most ductile of all materials, and when heated may be drawn into a thread very much finer than the threads of a spider's web.

DUDEVANT, *du d' vahN',* MADAME. See SAND, GEORGE.

DU'EL, a combat between two persons armed with deadly weapons. In ancient times duels were frequent, and in the Middle Ages "trial by combat," as it was called, was often resorted to with full consent of the Church. It was almost universally believed that might was right, and the victor in a mortal combat was held to have been justified and sustained by divine power. The duel became most common in France during the sixteenth century, where within eighteen years 4,000 persons were killed. In England and France strict laws were enacted forbidding dueling, but the laws were not rigidly enforced. Public opinion, once aroused, proved more powerful than the laws, and dueling fell into disrepute and was finally abandoned.

The most deadly of all duels were those fought in the United States. According to the code of honor prevailing in the eighteenth and the early part of the nineteenth centuries, quarrels could be settled and insults avenged only by combat. A very rigid code of etiquette was upheld, but the duel was fought with the distinct purpose of killing, and not merely wounding, as was usually the case in Europe. The challenged party was given the choice of weapons. In France and England the sword was the favorite dueling weapon; in America pistols were generally used. Charles Lee fought a duel with John Laurens; Aaron Burr and Alexander Hamilton met on the "field of honor," from which Burr fled branded as a murderer. It was not uncommon for both combatants to be seriously wounded, and sometimes both lay dead as the result of mistaken honor. Dueling was prohibited by law in the

District of Columbia in 1839, and after the War of Secession stringent laws were passed against it by the various states.

Except for mimic duels between German students and an occasional more or less ridiculous encounter in France, the practice of dueling has been entirely abolished. In all civilized countries a man who would now kill his opponent in a duel would be regarded as neither more nor less than a murderer.

DUFF, LYMAN POORE (1865-), a Canadian jurist, since 1906 puisne (junior) judge of the Supreme Court of the Dominion of Canada. He was born in Meaford, Ontario, was graduated from the University of Toronto with honors in mathematics and metaphysics in 1887, and two years later was graduated in law. After a brief experience as a teacher in the Barrie (Ontario) Collegiate Institute he practiced law, first in Ontario and after 1895 in British Columbia. He was counsel in many notable cases, and was associated with Edward Blake in the presentation of Canada's claims before the Alaska Boundary Tribunal in 1903. From 1904 to 1906 he sat as puisne judge of the supreme court of British Columbia.

DUFFERIN, *duf'fur in,* **AND AVA,** FREDERICK TEMPLE BLACKWOOD, Marquis of (1826-1902), a British diplomat, statesman and colonial administrator, Governor-General of Canada from 1872 to 1878, one of the most honored public men of his day. He was not a great statesman, but he had a remarkable gift for diplomacy. Both in public and private life he was what is best described as a "great gentleman"—always courteous and tactful, with a charming dignity and courtly manner which no difficult situation could ruffle.

DUFFERIN AND AVA

Though Lord Dufferin was born in Florence, Italy, he was of Irish parentage. His father, Price Blackwood, Baron Dufferin, was a naval officer and the owner of rich estates in Ireland. His mother, one of the most famous women of her time, was Helen Sheridan, granddaughter of Richard Brinsley Sheridan, the orator and dramatist. She and her sisters, Georgina and Carolina, were known to society in the days of George IV as "the Three Graces." As Lady Dufferin said, "Georgey's the beauty, and Carry's the wit, and I ought to be the good one, but I'm not."

Beginning life with every advantage, with talent, wealth and social position, young Frederick Blackwood was sent to Eton and to Christ Church, Oxford, and when he was only twenty-three years old was already a favorite at court. Politically he became attached to the Liberal party, under the leadership of Lord John Russell, through whose influence he was sent on several important foreign missions. Between 1864 and 1872 he held various offices in the Russell and Palmerston ministries. In 1850 he was given a seat in the House of Lords as Baron Clandeboye, and in 1871 was created Earl of Dufferin.

It was as Earl of Dufferin that he took the position of Governor-General of the Dominion of Canada. He was one of the most popular men who have ever made their home at Rideau Hall, and at a time when a weak or tactless Governor-General might have lessened the bonds between Canada and the Empire he unquestionably strengthened them. After resigning as Governor-General, Dufferin held a number of other important posts; he was ambassador to Russia from 1879 to 1881, then ambassador to Turkey for three years, viceroy of India from 1884 to 1888, ambassador to Italy until 1891 and then ambassador to France until 1896. Queen Victoria created him Marquis of Dufferin and Ava in 1888.

Lord Dufferin received many other honors. He was at one time president of the Royal Geographical Society, and in 1891 was elected lord rector of Glasgow University. Oxford and other universities gave him honorary degrees. He wrote a number of books popular in their day, including several of autobiographical character. G.H.L.

DUGONG, *doo'gong,* a marine animal somewhat resembling the whale, found in large numbers in the Indian Ocean and on the Australian coasts. The body is long and tapering, ending in a forked or crescent-shaped tail. The paws or flippers are entirely destitute of nails and are quite useless for any purpose except for swimming. The animal varies considerably in size. The largest are said to attain a length of twenty feet, but usually do not exceed eight or ten feet. The skin is thick, smooth, of a bluish color above and white underneath. The

dugong lives on sea plants which it finds in the mouths of large rivers. The female produces only one offspring at a time, and its

THE DUGONG

curious habit of carrying the young under its fin, as a woman might carry a child under her arm, is said to have given rise to the legends concerning those beings, half-human, half-fish, called mermaids. The dugong is related to the manatee, or sea cow. It is hunted and speared for its oil and also for its flesh, which is regarded as a delicacy by the Malays. See MERMAID; MANATEE.

DUISBURG, *düs'boorK,* a flourishing manufacturing town in Germany, fifteen miles north of Düsseldorf. It is connected by canal with the Rhine and the Ruhr rivers and is the center of the coal export trade of Westphalia. There are large iron foundries, steel and chemical works, breweries, sugar refineries and machine works. Duisburg is an ancient city, the Castium Deutonis of the Romans, and early became a prominent member of the Hanseatic League (which see). It possesses a beautiful church, dating from the fourteenth century, in which is the tomb of Mercator, the famous geographer. The municipality operates and owns all public utilities and from the water supply alone receives a profit of about $55,000 annually. Population, 1910, 229,480.

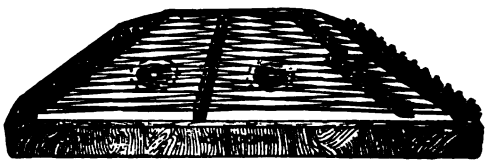
DUKE, one of the most exalted titles of European nobility. The word is derived from the Roman, *dux,* meaning *a leader,* and in ancient times the honor was purely military. *Duces,* or dukes, were placed in command of the troops in conquered territories, but were given no legislative power. Sometimes the military dukes made their power permanent and became the recognized rulers. The dukes of Normandy and Lombardy from military rulers became kings, while retaining the old title. The first English duke was the Black Prince, son of Edward III, the title of Duke of Cornwall being specially created for him.

Modern dukes have no powers above those of peers of lower order. In France the title carries no social or political distinction, but is merely used as an evidence of illustrious descent. The princes of the smaller states of the German Empire still retain the title of duke. A British duke is addressed as "Your Grace," or in writing, "The Most Noble, the Duke of ——." The eldest son is called *Lord,* with the rank of *Marquis.* Younger sons and all daughters of dukes are given the titles of *Lord* and *Lady* by courtesy. The wife of a duke is a *Duchess.*

Archduke. The title *archduke* is used only by members of the royal house of Austria. In the tenth century, Bruno, Duke of Lorraine, assumed the title, but it was not recognised as belonging solely to the Hapsburg family until about 1470.

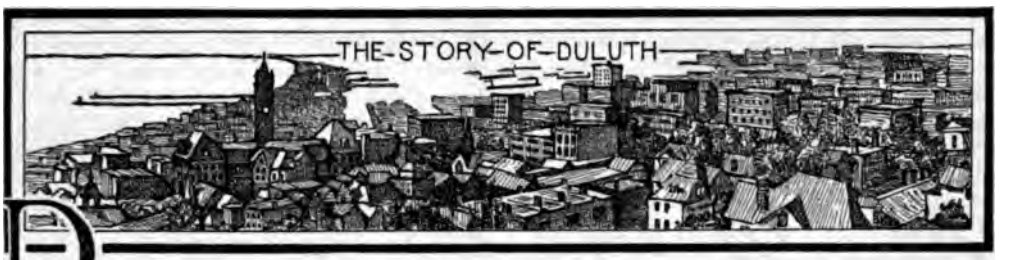
DUKHOBORS, *doo ku bawrz',* an interesting religious sect whose name of "spirit-wrestlers" has reference to their determined denial of the divinity of the Holy Spirit. The sect was founded in Russia in the early eighteenth century, and it grew rapidly, in spite of persecution; but governmental tyranny compelled the Dukhobors about the middle of the nineteenth century to emigrate, and many of them came to Canada. There they proved to be exemplary inhabitants, as their religious beliefs at no time interfere with their duty as citizens, despite the fact that theoretically they are opposed to government because the children of God, as they consider all people to be, can do no wrong and hence need no rulers. Marriages are contracted without ceremonies, but are looked upon as sacred.

DULCIMER, *dul'si mer,* a very ancient musical instrument which is quite a curiosity today, and of much interest because it was the forerunner of the piano. It was a flat box, of the form shown in the illustration, with a



A DULCIMER

sounding board over which metal wires were strung. On one side were pegs which held the wires in place, and by tightening them the instrument was tuned; it was played by striking the wires with two cork-headed mallets. The Crusaders brought it into Europe from the East, and after 1550 it was known by its present name.



DULUTH, MINN., county seat of Saint Louis County, is one of the most important inland cities in the United States. The population, which is one-third foreign-born, including English, French, Canadians, Swedes, Norwegians and Germans, was 78,466 in 1910, and 94,495 in 1916. Duluth is the most westerly port on the Great Lakes, situated on Saint Louis Bay, at the west end of Lake Superior, 156 miles northeast of Saint Paul, the state capital, and 478 miles northwest of Chicago. Duluth and Superior, Wis., are separated by the Saint Louis River; between the cities is a large interstate bridge. The vast commerce of the city is handled by lines of lake freighters and by the Northern Pacific; Chicago & North Western; Great Northern; Chicago, Milwaukee & Saint Paul; Duluth & Iron Range; Duluth, Missabe & Northern; Duluth, South Shore & Atlantic; Duluth, Winnipeg & Pacific, and the Minneapolis, Saint Paul & Sault Sainte Marie railroads.

Location. Duluth has an area of more than sixty square miles, and extends for a distance of twenty-four miles along the river, bay and lake, from Lakeside, on the north, to Fond du Lac, on the south. It is finely situated on a

DULUTH'S AERIAL BRIDGE

The car is run from shore to shore by electric power. It is about twenty feet square, with areas for wagons, automobiles and foot-passengers.

sloping bluff which rises gradually from the water to a height of 600 feet, one mile inland. The harbor is one of the finest in the United States. Saint Louis Bay, nine miles long and two miles wide, is formed and protected by narrow strips of land; Minnesota Point, seven miles long, extends southward towards Wisconsin Point, which projects northward. The bay is entered between the points and through a ship canal in Minnesota Point opposite Duluth. Across this canal is a curious aerial bridge 400 feet long and 186 feet high.

Parks and Drives. The principal residence section occupies the higher part of the city's area and overlooks the lake. Rogers Boulevard, lined with handsome residences, extends for seven miles along an old terrace of the lake and offers some of the finest views in the world. The parked area of the city is 400 acres; it includes five city squares and Lester, Lincoln, Fairmount and Chester parks, and several smaller ones.

Buildings and Institutions. Prominent buildings include the Federal building, county courthouse, Carnegie Library, Y. M. C. A. and Y. W. C. A. buildings, high school, Masonic Temple, and a number of fine hotels, banks and churches. On Minnesota Point is the United States government life-saving station and a fisheries building. Duluth is the seat of an Episcopal and a Roman Catholic bishop. It has a state normal school, Sacred Heart Institute, a technical school, and a county work farm.

Industries. Duluth is one of the principal interior shipping points in the United States, so located as to be the natural channel of the vast agricultural and mineral wealth of the Northwest. The principal exports are grain, lumber and ore from the territory of the Red River Valley, Manitoba and the Dakotas and the Vermilion and Mesaba mineral ranges. The annual shipments leaving the combined port of Duluth-Superior exceed 50,000,000 tons. The iron ore shipments in 1915 amounted to over 4,000,000 tons, a figure increased to over 7,000,000 tons for 1916. Duluth and Superior have some of the most extensive coal docks in the world. Other industrial establishments

include grain elevators, saw mills and flour mills, shipyards, slaughter houses, a ten-million dollar steel plant, erected in 1915 by the United States Steel Company, a blast furnace, iron works, machine shops, a cement factory, match factories, etc. Ample power for manufacture is supplied by a fall of 378 feet in the Saint Louis River.

History. Duluth received its name from Daniel de Grecylon, Sieur Du Lhut, a French trader and explorer, who visited this point about 1679. He traded with the Indians at Fond du Lac, which after 1752 was a depot of Astor's American Fur Company and is now about ten miles from Duluth. The place was settled about 1853, and the land was ceded by the Indians two years later. It was first reached by railway in 1870 and in that year became a city. In 1912 the commission form of government was adopted. G.D.MC C.

DUMA, *doo'mah,* the lower house of the Russian Parliament, officially the Imperial Duma, established by edict of the czar in 1905 and reorganized in its present form in 1907. The Duma was given to the nation in response to a growing demand of the people for participation in government, but the process of election to membership does not fairly distribute representation among the classes. There are 422 members, chosen for five years. The involved election machinery keeps in the majority the representatives of the wealthy landowners, and places the representatives of the mass of the people in the minority. The Duma has joint legislative power with the Council of the Empire, of 196 members, of whom one-half are named by the czar. Bills passed by these houses are subject to veto by the czar, and, if thus disapproved, cannot be voted on again without the ruler's consent.

The powers of the Duma, as well as of the Council of the Empire, are strictly limited. All measures regarding the army and navy are outside its jurisdiction. It has absolutely no voice in more than half the items which make up the annual budget; as for the other half, if the Duma disapproves it or the czar vetoes it, the government retains the power to levy special taxes in addition to renewing the budget of the preceding period. Any member may introduce a bill, but it must first be submitted to the Minister in whose department it falls. The Minister determines the form in which the bill shall be presented to the houses. Amendments, however, may be offered on the floor of the house and have sometimes been carried against the government. The czar has the power to issue a special ordinance (ukase) which has the force of law, at any time when the Duma is not in session; as the czar furthermore may prorogue or dissolve the Duma at his pleasure, these ordinances might easily become permanent. Finally, the czar may at any time proclaim martial law, thus superseding the civil statutes. This last step has been taken in Poland, in Finland and even in parts of Russia itself, in order that the opposition to the government's policy might be crushed by force. Under these circumstances it is little short of marvelous that the Duma has actually established its position as a branch of the government.

In spite of its limited functions, the Duma has steadily grown more powerful, and its voice has stirred to action men who were once heedless of public opinion. Especially after the outbreak of the War of the Nations in 1914 the Duma voiced the patriotism, the new nationalism, perhaps, of the Russian people. In 1916, for example, the resignation of a reactionary, strongly bureaucratic Ministry and the substitution of a more liberal one were generally attributed to the Duma's influence. The Duma was strongly in favor of a vigorous prosecution of the war, whereas there were influential men in the so-called bureaucratic circles who seemed to favor an early peace. See RUSSIA, subtitle *Government.*

DUMAS, *du mah',* the family name of two great French writers of the nineteenth century, father and son.

Alexandre Dumas (1802-1870), a French novelist and dramatist, called DUMAS THE ELDER to distinguish him from his son (see below), who inherited his literary ability. As a writer of thrilling romances, Dumas has no equal among French novelists, and his stories are probably the most widely-read in the entire realm of fiction. He was born in the town of Villers-Cotterets. His father, a general of Napoleon's army, was the son of a rich colonist of Haiti and a negress of the island. From the latter the novelist took his name Dumas, and from her, also, he inherited many of his mental and physical traits. In his youth he began the study of law, but, having had his interest awakened in the stage, went to Paris in 182[illegible] to try his fortunes as a dramatist. In order to live until his pen should support him, he took a position as secretary in the household of the Duke of Orleans, afterward King Louis Philippe, remaining there until 1830.

Dumas' historical drama *Henry III,* performed in 1829, was the first great triumph of the Romantic French drama (see ROMANTICISM), and was followed by numerous other plays that brought him both fame and wealth. About 1839 he began his career as a writer of fiction. One of his early historical novels,

DUMAS THE ELDER

Isabelle de Bavière, suggested to him that he might present the whole history of France in a great series of narratives that should "exalt history to the height of fiction," the outcome of his idea being a group of fascinating stories that have never been surpassed for vividness, dramatic action and power to absorb the reader's interest. The best-known of these are *The Three Guardsmen,* with its two sequels, *Twenty Years After* and *The Viscount Bragelonne,* and the matchless *Count of Monte Cristo.* The adventures of the young sailor who found the buried treasure on the island of Monte Cristo have been followed with breathless interest by innumerable readers.

The novels which bear the name of Dumas number about three hundred, but the only claim that he could lay to many of these was that he had either sketched the plots or revised them before they were printed. Once his fame was established he hired writers to do the mechanical part, while he supplied the ideas. His best work was done between 1843 and 1850, and the latter period of his life was spent in wanderings through Europe in search of "copy." Though he earned enormous sums of money, his extravagance and recklessness brought him to extreme poverty in his old age, and in his last days he was cared for by his son.

Alexandre Dumas (1824-1895), son of the great novelist, is known as DUMAS THE YOUNGER. He began his literary career with a book of poems (1847), but his first real success came a year later with the novel *La dame aux camélias,* better known by its English title of *Camille* (which see). A dramatization of the book, presented in 1852, created a sensation, and the play has been enormously successful since then because of the opportunities it affords the actress who assumes the title rôle. The rôle of Camille was one of the triumphs of Sarah Bernhardt. In all of Dumas' plays he seeks to teach stern lessons of morality to a gay and thoughtless world. Among his other dramas are *The Money Question, The Prodigal Father* and *The Wife of Claude.* He was highly gifted as a dramatist, and he was elected to the French Academy in 1874. C.W.E.

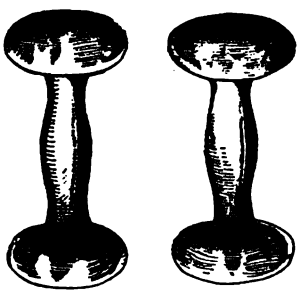
DU MAURIER, *du mo rya',* GEORGE LOUIS PALMELLA BUSSON (1834-1896), an English story-writer and illustrator, whose best-known novel, *Trilby,* created a sensation on its publication in 1894. Trilby, the heroine, is an artist's model who is brought under the influence of a Hungarian musician. By means of mesmerism she becomes one of the greatest singers of her time, but when her teacher dies she loses her powers. The book has strong dramatic qualities; a play founded on it was successfully staged in England and America.

Du Maurier, of French descent on his father's side, was born in Paris, but he entered University College, England, at the age of seventeen, and in the course of time became a naturalized British subject. In 1856 he chose art as a profession, studied in Paris and in Antwerp, and began his career as an illustrator for London publications.

In 1864 he became a regular member of the staff of *Punch,* and his drawings for that periodical gave him an enduring reputation as a skilful portrayer of the social follies of his time. Among the books for which he made illustrations are Thackeray's *Henry Esmond* and *Ballads,* Foxe's *Book of Martyrs* and novels of Henry James, Thomas Hardy and George Meredith. In addition to *Trilby* he wrote two novels, *Peter Ibbetson* and *The Martian,* and he was also the author of light, graceful verse.

DUMB-BELLS, wooden or iron weights, consisting of two balls connected by a bar a few inches in length and used in physical exercises.

In practicing with them a person holds a dumb-bell by the bar in each hand and follows a regular system of gymnastic exercises. Ordinary dumb-bells weigh from one to five pounds each, but in trials of strength very heavy ones are used. In the reign of Elizabeth dumb-bells were first made in their present form, but in the early Grecian games weights, called *halteres*, which were similar, were thrown by the quoit players.



DUMB-BELLS

DUN'BAR, PAUL LAURENCE (1872-1906), an American negro poet, of pure African blood. He was the first of his race to express in poetry of a high order the characteristics and feelings of the American negro, but he died before his unusual powers were fully developed. His refined and delicate art is best represented by his dialect poems, in which his gift of sympathy, insight into the mind and heart of the negro and sense of humor find expression in simple and picturesque language. He was born in Dayton, Ohio, of parents who had both been slaves. The boy was given a high school education and began his literary work as a journalist in New York City. For a time he was on the staff of the Library of Congress at Washington, D. C. His collected poems are published under such titles as *Oak and Ivy, Lyrics of Lowly Life, Candle-Lightin' Time, Li'l Gal* and *Joggin' Erlong*. Among his prose writings are a volume of short stories, *Folks from Dixie*, and a novel, *The Uncalled*.

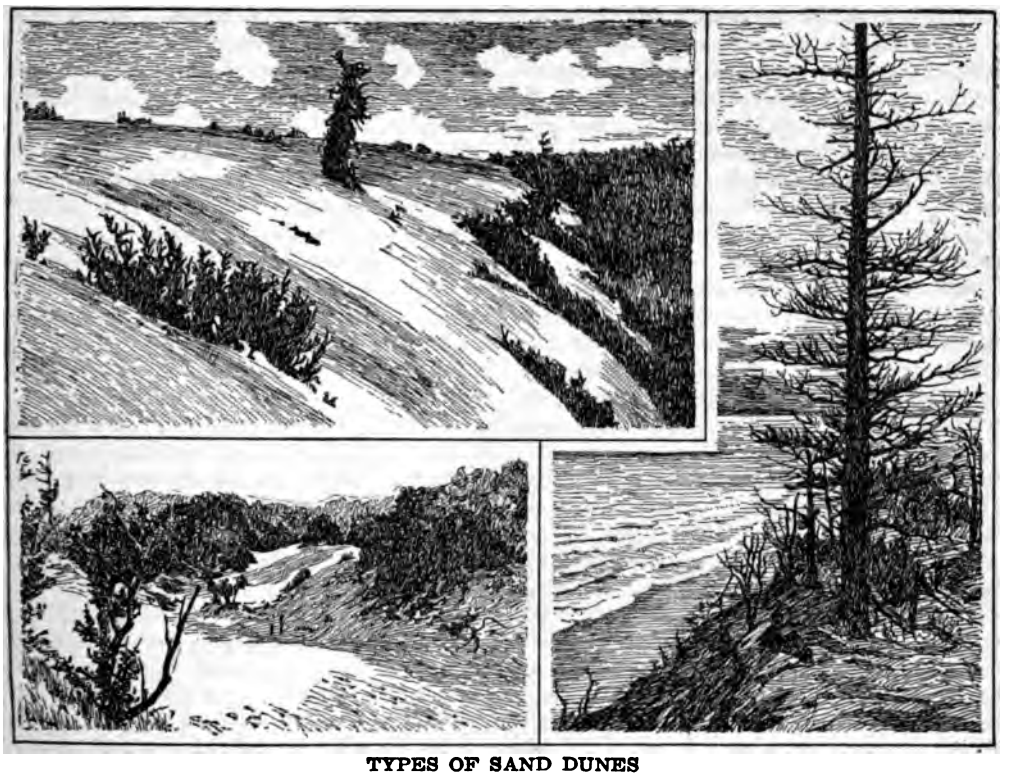
DUN'CAN, NORMAN (1871-1916), a Canadian novelist and educator, known for his sympathetic sketches of life among the fishermen of Newfoundland and Labrador. He was born at Brantford, Ontario, and was graduated from the University of Toronto in 1895. After working on a New York newspaper for several years, he was in turn professor of rhetoric at Washington and Jefferson College, special correspondent in Asia Minor and Egypt for *Harper's Magazine*, and then professor of English literature at the University of Kansas. In the meantime he had won considerable favor with the reading public with his stories of Labrador, including *Doctor Luke of the Labrador; Dr. Grenfell's Parish* and *The Way of the Sea*. Among his later works should be mentioned *The Cruise of the Shining Light; The Adventures of Billy Topsail; Billy Topsail & Company; The Measure of a Man; A God in Israel; The Bird-Store Man;* and *Australian Byways*. In 1912 Pittsburgh University granted him the degree of Litt. D. G.H.L.

DUN COMMERCIAL AGENCY. See COMMERCIAL AGENCIES.

DUNDAS', a town in Wentworth County, Ontario, is five miles west of Hamilton, fifteen miles east of Brantford and forty-five miles southwest of Toronto. It lies in a pretty valley between two escarpments, or heights of land. The Toronto, Hamilton & Buffalo and Grand Trunk railways run through Dundas, and freight is also transferred over electric interurban lines to the Canadian Pacific and Michigan Central railways at Hamilton. Population in 1911, 4,299; in 1916, 4,652.

In the early days Dundas was known as the "Head of the Lakes," and a large part of the trade of Northern and Western Ontario was carried on through the town. The Desjardins Canal, now trafficless, though still extending to Lake Ontario, was then a busy commercial waterway. With the advent of the railway, however, the water trade gradually passed to other cities more favorably located, and Dundas, with an abundance of water power, became primarily a manufacturing community. Machine tools are the product of the largest establishment in the town, and leather, gloves, baskets, clothing, yarns and knitted goods, church and school furniture and gasoline engines are also important. Dundas was founded in 1801, and was incorporated as a town in 1847. It was named for Henry Dundas, Viscount Melville (1742-1811), a British statesman who was a conspicuous supporter of Lord North's policy toward the American colonies. C.E.D.

DUNDEE', a seaport in Forfarshire, Scotland, often spoken of as the GRANITE CITY, on account of the granite of which it is built and which is extensively quarried in the vicinity. The name is a corruption of the Gaelic *Dun-taw*, meaning the *fort on the Tay*. The city is situated on the north shore of the River Tay, ten miles from the sea and fifty miles northeast of Edinburgh. It is well laid out, with broad streets and a splendid esplanade along the river bank. Dundee is the center of the British jute trade and also produces more linen goods than any other town in Scotland. Shipbuilding and engineering are important industries. Until recent years Dundee sent



TYPES OF SAND DUNES

The three illustrations are from photographs taken on the southeastern shore of Lake Michigan, in what it is expected will some day be Indiana Dune Park.

out many vessels to the northern seal and whale fisheries, but that industry is now comparatively of little importance. The city is one of the naval aeroplane stations of Great Britain.

The public utilities are owned by the municipality and are profitably operated, all surplus being devoted to the reduction of taxation. During the almost constant struggles between England and Scotland Dundee frequently changed hands. In 1385 it was burned by the Duke of Lancaster, and in 1651 General Monk sacked and burned it after massacring 1,000 of the inhabitants. Population, 1914, 176,062.

DUNE, a hill or mound, common in all sandy regions, formed of sand drifted by the wind. The wind blows the sand like snow, and when it strikes any obstruction it falls. Each succeeding wind adds to the amount first deposited, and in this way a small mound grows in the course of years to a hill.

Sand dunes are most numerous in desert regions and on or near large bodies of water. They occasionally reach a height of 500 or 600 feet, but most of them are much lower. Sometimes their surface becomes rippled by the wind, and presents an appearance similar to that of a lake stirred by a gentle breeze. Dune Park, Indiana, on the south shore of Lake Michigan, is one of the most remarkable dune regions in the world. It is not in reality a park, that name being given the miles of sandy waste and scrub oak by courtesy; but in 1916 steps were taken to form the territory into a state park by action of the legislature. The Indiana dunes are among the most interesting formations of the kind in the world, and great geographers make long journeys to view and study them. The eastern shore of Lake Michigan is also noted for its dunes.

DUNEDIN, *dun e'din*, one of the principal cities of New Zealand, and capital of the district of Otago. It is situated in the South Island, at the head of a fine natural harbor fifteen miles from the sea. The city was founded in 1848; in 1861 it became the center of a rich gold-mining district and from that date its growth was rapid. It is connected by rail with Christchurch in the north, with Invercargill in the south, and by a regular line of steamers with Australian ports. The surrounding country is noted as a wool-growing section;

the city manufactures large quantities of woolen goods for home consumption and exports raw wool to England. Apart from agriculture the chief source of wealth lies in gold dredging, which, however, is now almost entirely in the hands of a few large companies. Dunedin has beautiful suburbs, on hills overlooking the harbor, each suburb forming a separate municipality. Population in 1911, of the city alone, 41,529; with suburbs, 64,237.

DUNFERMLINE, *dun ferm'lin,* an ancient city of Scotland, in the County of Fife, sixteen miles northwest of Edinburgh. It was the favorite residence of early Scottish kings and the birthplace of James I and Charles I of England. The name is Gaelic, and means *fort on the crooked stream.* It was an important town before the days of the Norman conquest of England (1066) and is full of interesting historical remains. Beneath the pulpit in the Abbey church, built on the site of an ancient Benedictine abbey, lie the remains of King Robert Bruce, hero of Bannockburn (which see). Until the eighteenth century the town had no manufactures, but in 1718 the weaving of damask was introduced by a man who by pretending to be an idiot had gained entrance to workshops in Edinburgh and learned the strictly-guarded secrets of the art. Dunfermline soon surpassed Edinburgh and all other towns in Great Britain in the quality and design of its damask.

Andrew Carnegie was born in Dunfermline in 1837, and has been the town's greatest benefactor. He presented to the city of his birth a public library, baths and the beautiful estate of Pittencrief Park, together with other property and bonds yielding an income of $125,000 a year. Daniel Defoe described Dunfermline in the eighteenth century as showing the "full perfection of decay," but it is now among the most flourishing towns in Scotland, with important industries, including brass and iron founding, tanning, brewing and distilling, rope making and bleaching; there are numerous collieries in the immediate vicinity. Population in 1911, 28,100.

DUN'KERS, DUN'KARDS or **TUN'KERS,** from the German *tunken,* meaning *to dip,* is the name of a sect of German-American Baptists which originated in Westphalia, Germany, about 1708. Their founder was Alexander Mack. They derive their name from their mode of baptism by immersion, or dipping. Early in their history persecution compelled them to flee to Holland, and later they emigrated to the United States, where they settled near Philadelphia. They are distinguished by extreme simplicity of attire, and are opposed to divorce, oaths, warfare and the use of alcohol and tobacco. They reject infant baptism and the use of medicine, replacing the latter with prayer and anointment with oil. They are now found in almost every section of the United States, particularly in Pennsylvania, Maryland, Virginia, Ohio and Indiana. In 1905 their total membership was about 115,000.

DUN'KIRK, or **DUNKIRQUE,** is a fortified seaport in the north of France on the Strait of Dover, twenty-eight miles northeast of Calais. During the War of the Nations it was an important military base and landing place for British troops. It was repeatedly shelled by long-range German artillery, at a distance of twenty miles, for it was in the direct line of German aspirations looking to the capture of the entire Channel coast of France, especially Calais. This campaign failed, and the bombardment did not entirely destroy Dunkirk.

The city lies in a network of canals connecting it with inland towns of France and Belgium, and has an excellent harbor, its importance as a port rivaling that of Bordeaux. It has manufactories of jute, hemp, cotton and flax, iron foundries, machine factories, breweries, sugar refineries and shipbuilding yards. The streets are wide, well paved and clean, but there are few buildings of any architectural beauty. Population in 1911, 38,891; but during the War of the Nations thousands sought refuge elsewhere, and business interests suffered greatly.

DUNKIRK, N. Y., a city in Chautauqua County, on the shore of Lake Erie, forty miles southwest of Buffalo. It is on the New York Central Lines; the Pennsylvania; the Erie; the New York, Chicago & Saint Louis and the Dunkirk, Allegheny Valley & Pittsburgh railroads. Lines of freight and passenger boats ply between this and other lake ports. In 1910 the population was 17,221; in 1916 the Federal estimate was 20,743. The area is nearly five square miles.

The city was named from the similarity of its excellent harbor, which is protected by a breakwater, to that of Dunkirk, France. It is well situated on bluffs high above the lake, and has Point Gratiot and Washington parks, Brooks Memorial Hospital, a Carnegie Library, Masonic Temple and Odd Fellows' Temple. Dunkirk is in an agricultural and grape-growing country and has an important trade in farm

produce and in food fish taken from the lake. The industrial enterprises include locomotive works, which employ 3,500 men, steel axle and radiator factories, planing mills and glove and shirt factories.

A settlement at Dunkirk in 1805 was incorporated as a village in 1837. It became a city in 1880.

DUNMORE, PA., a residential suburb of Scranton, which it adjoins on the southwest. It is situated in Lackawanna County, in the northeastern part of the state, and is served by the Erie Railroad. Electric lines extend northeast and southwest of the city. In 1835 the first settlement was made, and in 1862 the borough was incorporated. Italians, Poles, Slavs and Hungarians comprise one-third of the population, which increased from 17,615 in 1910 to 20,776 in 1916. The area exceeds eight square miles.

Though Dunmore is primarily the residence of a large number of people who have employment in Scranton, it has large home interests in anthracite coal mining, about 5,000 people being engaged in this industry. The city has Saint Mary's Academy, the State Oral School for Deaf and Dumb, Saint Joseph's Infant Home, and homes for the aged and friendless.

DUNNE, *dun,* FINLEY PETER (1867-), an American journalist and humorist, was born and educated in Chicago. He gained wide newspaper experience on the staff of Chicago newspapers, and became famous through his creation of the character of *Mr. Dooley,* the genial philosopher of Archey Road, for whom a Chicago newspaper man furnished the inspiration. Mr. Dunne is the author of *Mr. Dooley in Peace and War, Mr. Dooley in the Hearts of His Countrymen, Mr. Dooley's Philosophy,* etc. He has for some years syndicated his material, thus bringing *Mr. Dooley* and himself nation-wide publicity.

DUNN'VILLE, a town in Haldimand County, Ontario, forty-three miles west of Buffalo and thirty-four miles southeast of Hamilton, on the Grand Trunk Railway and the Grand River; this is navigable from its mouth in Lake Erie to this town, a distance of five miles. Dunnville is also served by a branch line of the Toronto, Hamilton & Buffalo Railway. It is an important manufacturing center, the chief products being flour, knitted and woolen goods, canned and dried fruits and vegetables, sewing machines, hammocks, bricks and boats. Population in 1911, 2,861; in 1916, estimated, 3,300.

DUNSMUIR, *dunz'mewr,* JAMES (1851-), a Canadian capitalist and legislator, formerly premier and later lieutenant-governor of British Columbia, and one of the wealthiest men in the province. He was born at Fort Vancouver, Washington, attended school at Nanaimo, British Columbia; Hamilton, Ontario; and Blacksburg, Virginia, and then was given a business training by his father, who developed the first important coal mines in British Columbia. On the death of his father, Dunsmuir became president and chief owner of various coal companies and also of the Esquimalt & Nanaimo Railway, which he sold to the Canadian Pacific Railway in 1905. He has given largely of his wealth to educational and charitable institutions. Dunsmuir entered the British Columbia legislature as a Conservative in 1898, and from 1900 to 1902 was premier and president of the council. From 1906 to 1909 he was lieutenant-governor of the province. G.H.L.

DUNS SCOTUS, *dunz sko'tus,* JOANNES (1265-1308), was a Roman Catholic divine and one of the most profound thinkers of the Middle Ages. His birthplace is unknown. He entered the Order of the Franciscans, studied at Oxford and in 1301 became professor of theology there. He successfully defended the doctrine of the Immaculate Conception, afterwards (1854) declared a Roman Catholic dogma, against Thomas Aquinas, a noted Dominican scholar. For his brilliant handling of the matter he was awarded the title of *Doctor Subtilis,* or the *Subtle Doctor.* The Scotist philosophy establishes the necessity for divine revelation on the ground that reason is insufficient to teach us the highest end of our existence, the knowledge of God. The most famous work of Duns Scotus, besides his commentaries on the Bible and Aristotle, is the *Opus Oxoniense* ("Oxford Work").

DUNSTAN, SAINT (925-988), an English archbishop and statesman, was born and educated at Glastonbury, and afterwards became abbot of the monastery there. During the reigns of kings Edmund and Edred, Dunstan acted as their adviser, instituting many wise religious reforms and aiding in the conquest of the Danes. He gained the ill-will of King Edwy, successor of King Edred, because he had publicly rebuked him, and as a result of this act he was deprived of his offices and banished. He returned to England in 958, was made bishop of London in 959 and Archbishop of Canterbury in 960. Edgar, Edwy's successor, approved of Dunstan's reforms, and gave him every assist-

ance. On the death of Edgar in 975, Dunstan again lost prestige and retired to Canterbury, where he remained until his death. He was considered a great scholar and statesman who labored energetically toward the advancement of religious freedom.

DUNVE'GAN, a town in Northern Alberta, on the Peace River, 275 miles directly northwest of Edmonton and about 340 miles by rail. The Edmonton, Dunvegan & British Columbia Railway, under construction in 1917, will provide transportation both east and west. Dunvegan has been known for many years as a Hudson's Bay Company post, with a population of a score or two. The completion of railways to the Peace River country, however, will make it a central outfitting and distributing point. For detailed information, see PEACE RIVER.

DUQUESNE, *doo kane',* PA., a borough in Allegheny County, in the southwestern part of the state, one mile from McKeesport and twelve miles southeast of Pittsburgh, on the Monongahela River and the Pennsylvania Railroad. The city has extensive blast furnaces and steel works. It was settled in 1885 and was incorporated in 1891. The population was 15,727 in 1910, and 19,964 in 1916. The area is about two square miles.

DURANGO, *doo rang'go,* capital and leading commercial city of the state of Durango, in Mexico. It is situated on an elevated plateau nearly 7,000 feet above sea level and about 500 miles northwest of the city of Mexico. The climate is mild and healthful and the surrounding district is extremely fertile. The city has cotton and woolen mills, iron foundries, tobacco factories and large flour mills, and in normal times is the center of important mining industries. Hot mineral springs are numerous in the vicinity. Population in 1910, 34,085.

DURANT', HENRY FOWLE (1822-1881), the founder of Wellesley College. His life is recorded under the description of that school, in Volume VIII.

DUR'BAN, the chief seaport of the province of Natal, in the Union of South Africa. The town was founded in 1834 and named after Sir Benjamin D'Urban, then governor of Cape Colony. The business section of the town is situated mostly on low-lying land on the north of its harbor, which is known as Port Natal. The residential district is on a range of hills called the Berea, overlooking the harbor. There is an excellent street railway service, but "rickshaws" (see JINRIKISHA) drawn by stalwart Zulus are still popular vehicles. Extensive dredging operations in 1904 opened the harbor to the largest mail steamers, and all the import and export trade of Natal and a great quantity of that of the Orange Free State and the Transvaal now passes through Durban. Population in 1911, 72,512.

DURBAR, *dur'bahr,* a Persian word meaning *audience,* but now used chiefly in India with reference to conclaves at which treaties and other important affairs of state are discussed, and also to great meetings held to pay honor to distinguished visitors. Queen Victoria was declared Empress of India in 1877 at Delhi before the princes, rulers and chiefs of India assembled "in durbar." King George V and Queen Mary were similarly greeted in 1911 at a durbar of great magnificence. The native princes vied with each other in making the most gorgeous display, the wealth represented by the jewels and precious stones worn in gaily-colored Eastern dresses and turbans being almost fabulous. It was immediately following that event that Delhi was made the Indian capital, Calcutta losing the distinction.

DÜ'RER, ALBRECHT (1471-1528), a German painter, engraver and designer, the greatest master of the period known as the German Renaissance (see RENAISSANCE), and one of the most influential artists his country has ever produced. He was born in Nuremberg, where he worked for a time with his father at the goldsmith's trade. At the age of fifteen he became apprentice to the painter Wohlgemuth, studied with him for three years, and after spending four years in travel as a journeyman painter settled in Nuremberg as an independent master.

In 1505 he visited Venice, where his study of the Venetian masters refined his art and broadened his vision. Even more important was the influence of the early Flemish painters (see EYCK), whose works he studied while on a visit to the Netherlands in 1520. His own paintings thereafter showed an excellence in coloring that was formerly lacking, and his return to Nuremberg marked the beginning of his last and greatest period.

As a creative and transforming force in German art, Dürer holds first place. His theory that art should be a record of fact is illustrated in the accuracy of his portrait painting. He invented a process of printing woodcuts in two colors, and perfected the art of engraving by combining the methods used in etching and engraving on copper. Excellent examples of

his engravings are *Death and the Devil* and *Saint Jerome in His Study;* famous among his woodcuts are *The Smaller Passion* and *The Apocalypse.* His masterpiece of religious painting is *The Four Apostles,* now in the Munich Gallery, consisting of two panels of life-size figures of the Apostles John and Peter, Mark and Paul. Dürer enjoyed high honor and esteem in his lifetime; he was court painter for the emperors Maximilian I and Charles V. Among his friends were Luther, Melanchthon, Erasmus and Raphael. B.M.W.

DURHAM, *dur'um,* JOHN GEORGE LAMBTON, Earl of (1792-1840), an English statesman, known to his contemporaries as "Reformer Jack," one of the most radical of the Liberal leaders of his day; now remembered chiefly as the principal author of the great Reform Bill of 1832 and as the writer of a *Report on the Affairs of British North America,* a document which was directly responsible for the union of Upper and Lower Canada and laid the foundation of British colonial policy up to the present time. Lord Durham was a great popular leader, and filled a larger place than many men whose names are familiar to-day. If his fame is dimmed by time, and if an early death robbed him of the highest honors, yet the principles for which he fought have triumphed.

EARL OF DURHAM

Though the Lambtons were a family which had for nearly seven hundred years owned a vast acreage of land, the family traditions were of a pronounced Whig type. The grandfather of the Earl of Durham had refused a peerage, and his father was a vigorous defender of popular rights. Young Lambton was sent to Eton, and then for a short time held a commission in a regiment of Hussars. In 1816 he married Louisa Elizabeth, daughter of Earl Grey. She was his second wife; his first wife, with whom he had eloped to Gretna Green in 1812, died early in 1815. Meantime, on reaching his majority in 1813, he was elected to the House of Commons, where he became a fearless advocate of reform and generally opposed the Tories. His marriage to Earl Grey's daughter strengthened his political position, and by 1818 he seems to have been more or less in the confidence of his father-in-law and other Whig leaders. But he was too radical for these aristocrats, and their distrust of him was not lessened by his great speech in 1821 on Parliamentary reform. This was eleven years before the Reform Bill, yet in it he advocated more thoroughgoing reform than provided by that law. In 1828 Lambton was raised to the peerage as Baron Durham.

In November, 1830, when Earl Grey succeeded the Duke of Wellington as Prime Minister, Durham entered the Cabinet as Lord of the Privy Seat. He was almost immediately appointed chairman of a committee of four to draft the Reform Bill. Most of the work was done by Durham himself, the other three members being his assistants rather than collaborators. Durham himself selected one of them, Lord John Russell, to present the bill to Parliament. After the passage of the Reform Bill, Durham undertook a special mission to Russia, and on his return in the spring of 1833 was created first Earl of Durham and Viscount Lambton. He was again ambassador to Russia, from 1835 to 1837.

His Services to Canada. As early as July, 1837, Viscount Melbourne, then Premier, urged Durham to undertake the government of Canada, where affairs had come to an alarming crisis. Durham at first refused, but some months later accepted. By a special act of the British Parliament he was given almost dictatorial powers in Canada, and he had the assurances of Melbourne that the government would give him "the firmest and most unflinching support." Durham arrived at Quebec on May 27, 1838, and sailed from Quebec for England on November 3 of the same year. In this brief period he gained a marvelous insight into the true needs of Canada. The rebellions led by Papineau and William Lyon Mackenzie had already been crushed, but disaffection still remained. Durham, loath to punish the rebels as traitors, issued a proclamation of amnesty on June 28, 1838, the day of Queen Victoria's coronation. From the benefits of this proclamation twenty-four of the leaders were excluded. Eight of them were already in prison and were to be exiled to Bermuda; the remaining sixteen, including Papineau, were fugitives, and were forbidden to return to Canada on penalty of death.

Durham was undoubtedly justified in feeling that this extraordinary use of his power would be sustained, and public opinion of the

colonies did support him, but in England partisan motives led to violent attacks against him, on the ground, which could not be denied, that he had exceeded his powers. The Melbourne Ministry, false to its promise, did not defend Durham, and the Canadian ordinance which was to carry Durham's plan into effect was disallowed by the home government.

Durham, high-spirited and hot-headed, was indignant at this reversal, and left Canada without waiting for his resignation to be accepted. In his famous report on the conditions he found, one of the greatest state papers in the English language, he outlined the future of Canada. Believing that the ideal to be kept in view was a federation of all the colonies in North America, he advised the legislative union of Upper and Lower Canada as the first step. He also urged that the mother country furnish aid to immigration, that an intercolonial railway be built at once, and that an executive council responsible to the legislature be established. Durham's health had long been failing, and he lived to see only the first of his suggestions adopted; he died on July 28, 1840, just five days after Queen Victoria had given her assent to the act uniting Upper and Lower Canada. G.H.L.

DURHAM, N. C., a city famous for its tobacco industry. It is the county seat of the county of the same name, situated about midway between the geographical center of the state and its northern border. Raleigh is twenty-six miles southeast, Greensboro is fifty-five miles west, and Washington, D. C., is 288 miles northeast. Transportation is provided by the Southern, the Seaboard Air Line, the Norfolk & Western, the Durham & Southern and the Durham & South Carolina railways. The population increased from 18,241 in 1910 to 25,061 in 1916; about one-third of this number are negroes. The area of the city exceeds three and three-quarters square miles. The city is popularly called the *Bull City*, because a fine breed of cattle is known as the *Durham*.

Durham is the center of an important tobacco and cotton district, and the manufacture of a famous brand of smoking tobacco is the staple industry of the city. The plant engaged in its production is one of the largest granulated smoking-tobacco factories in the world. The manufactures of snuff, cheroots, cotton knitted goods, fertilizers and dyestuffs are also important. Watts Hospital (white), Lincoln Hospital (colored), the post office and a library are the notable buildings. In addition to its public school system the city has Trinity College (Methodist Episcopal), opened in 1851, a school of fine arts, a conservatory of music and a business school.

The city was settled in 1855, incorporated in 1869 and made the county seat in 1881. It was named for Dr. Bart Durham. Z.A.R.

DUSE, *doo'za*, ELEANORA (1859-), a great emotional actress, was born in Vigevano, Italy. She began her career at an early age and in commonplace surroundings. Her genius remained unrecognized until in 1879 she appeared at Naples in Zola's *Therese Raquin*. She was undoubtedly the inspiration of many of Gabriele D'Annunzio's best-known plays, in which she appeared; among these are *Gioconda* and *Francesca da Rimini*. She abstained from theatrical make-up and mannerisms, and her art, while simple, was distinguished by great intensity. In the characters of *Santuzza, Camille* and *Marguerite,* she achieved her greatest triumphs. Her tours in the United States and Canada between the years 1893 and 1903 were artistically and financially successful. Soon after her return to Italy from her second American tour she retired from the stage.

DÜS'SELDORF, a famous art, educational and industrial center of Germany, and one of the most beautiful cities of the empire. The town dates from about 1250. It is situated at the confluence of the rivers Düssel and Rhine, twenty-two miles northwest of Cologne, and is divided into five sections. In some parts the streets are crooked and narrow, but the more modern portions are well planned, with fine buildings, well-shaded avenues and large squares. It is only within recent years that the city has become industrially prominent, iron and steel manufactures having been developed with great rapidity. There are also manufactures of cotton goods, carpets, leather, tobacco and chemicals. All public utilities are municipally owned and operated by the city with the efficiency for which the Germans are noted. The Düsseldorf school of painting, an outgrowth of the Academy of Art founded in 1767 by the Elector Karl Theodor, is still the most important of all German art schools. Population in 1910, 358,728.

DUST, ATMOSPHERIC. Of the variable constituents of the atmosphere, water vapor and dust, strangely enough, are closely dependent one upon the other. When the temperature of the atmosphere falls to the dew point—that is, the temperature at which water vapor changes to a liquid form—the condensation

takes place very gradually. The dust particles cool more rapidly than the gaseous parts of the air, and each particle becomes the nucleus of a droplet of mist. The masses of mist form cloud, from the lower surface of which the mist gathers into rain drops. Were it not for this beneficent provision of nature almost every rainstorm would be a fierce deluge of down-pouring water out of a cloudless sky. There would be no gentle summer showers; and if there were clouds the clouds would be of a form and composition now unknown. A knowledge of the nature of the dust content of the atmosphere is quite as important as that of the water-vapor content, for, in a way, it has quite as much to do with the distribution of rain. It is not far from the truth, therefore, to say that atmospheric dust is the parent of cloud, just as cloud is the parent of rain.

Two Kinds of Atmospheric Dust. Broadly speaking, atmospheric dust may be classed as consisting of two kinds: the dust motes or floating matter of the air, and the flying dust that is swept from bare surfaces of the ground and carried into the air by the wind. A distinction of this sort, however, is not exact; it is merely one of convenience, for there are dust motes that settle to the ground, and particles of flying dust that practically do not. Theoretically, all matter not in gaseous form is supposed to settle to the ground; practically, much of it remains in suspension for an indefinite length of time. Every fall of rain or of snow brings these particles to the ground in numberless millions; electrification and winds drive them into the air again. If the earth and the dust motes are similarly electrified the latter are repelled. At such times they accumulate until the air next the ground becomes more or less hazy.

Mr. John Aitken, a Scotch meteorologist, has devised a very ingenious method of estimating the number of dust motes in a given volume of air. A measured quantity of air confined in a receiver is suddenly cooled below the dew point. The moisture of the air condenses on the dust motes and they fall upon a plate of black glass ruled in such a manner that the droplets may be readily counted with a strong magnifying glass. Mr. Aitken finds that if the air contains not more than 8,000 dust motes per cubic inch, it is fairly clear and the outlines of distant objects are plainly visible. On the other hand, when about four times that number are present, the air is very hazy. On a very clear day following a shower, the number may be less than 4,000 per cubic inch; ordinarily, however, the number is not far from 8,000 to 12,000 per cubic inch.

Sources of Dust Motes. Dust motes come from various sources. Undoubtedly some are particles of wind-blown earthy matter that by long attrition, or wearing away, have become so minute that they remain suspended in the atmosphere until brought down during a shower. A large proportion are of volcanic origin. The eruption of Krakatoa, in Sunda Strait, ejected so much floating matter into the atmosphere that red sunsets and hazy conditions caused by it lasted for several years. The chimney stacks out of which the burnt products of ten billion tons of coal are yearly poured also account for a considerable proportion of the motes. The wind-whipped sand of the sea furnishes its quota, and the proportion is not small. The "chlorine zones" which so many boards of health in seacoast cities are now studying are strips of seacoast in which salt prevails in the air. But many dust motes are of meteoric origin—that is, they are matter which, for want of a better name, may be called *planetary dust,* which the earth gathers from space. Some of these particles are very much like the lava of terrestrial volcanoes; some are spherules of iron. The latter may be gathered by a magnet from the dust accumulations of undisturbed niches and corners; they may be gathered also upon a microscope slide which rests upon a magnet. In any case the difficulty in examining them is considerable, and the slightest jar will cause them to fly into the air.

Dust motes apparently do not affect the sanitary condition of the air. There is no evidence to show that the health of a community is affected by them. Because they are such important factors in the production of rain, dust motes should be considered, not as "foreign matter of the air," but as a real and essential part of it; moreover, without a knowledge of the part they play, the study of atmospheric moisture is incomplete.

Flying, or Wind-Blown, Dust. The flying, or wind-blown, dust of the atmosphere at first thought might appear to differ from the dust motes only in the size of the particles; as a matter of fact, however, the work they perform in nature is vastly different. Dust motes exist at a height of ten miles or more in the air; flying dust rarely is carried higher than a few hundred feet. Yet in that low altitude

flying dust is a physiographic agent that performs a wonderful amount of work. Flying dust, snatched from the deserts of Central Asia, is borne across high mountains and has filled the valley of the Hoang River, "China's sorrow," hundreds of feet deep. The wind-blown dust—*locss*, it is called— is brought into the valley more rapidly than the river can carry it away. As a result, the sediment which the river tries to carry, but cannot, causes overflows and floods that are terribly destructive. Years ago the Hoang flowed into the delta of the Yang-tse-kiang; now its mouth is in the Pechili, several hundred miles north of the Yang-tse delta. Flying dust filled and leveled the valleys between the block mountains of the Western highland region; it cut the Gulf of California in two, leaving the remnant now known as Imperial Valley; and it was the chief factor in leveling the surface of the plains between the Missouri River and the Rocky Mountains. Wind-blown sand is forever rearranging a considerable part of the coast line of the United States, thereby making the work of the Coast Survey a never-ending task.

The wave of sand which swept Cape Henlopen, on the east coast of Delaware, is an illustration of the movement of flying and rolling dust. It must be borne in mind that any slight increase in the velocity of the wind adds enormously to its carrying power; doubling its velocity increases the carrying power sixty-four-fold. The burning of the shrubbery and trees left a denuded area of sea sand. The wind immediately began to blow the sand, which had been protected from it by the shrubbery, and in a few years a drifting dune about a mile long and seventy feet high began to travel westward. In the course of fifty years the dune traveled westward a mile or more, stopping only when the force of the on-shore winds was balanced by that of the currents blowing from the land.

In the foregoing cases it should be noted that the tremendous effects of wind-blown dust are confined to areas that have but little rainfall and, therefore, little or no shrubbery and vegetation. The flying dust in such regions consists almost wholly of earthy matter, and its composition does not differ from that of the rock from which it is worn.

Varieties of Wind-Blown Dust. In regions of generous rainfall the ground is protected by grass and other vegetation. About the only denuded surfaces, sea and lake shores excepted, are public streets, playgrounds and areas in which constant treading prevents the growth of vegetation. As compared with arid regions the amount of flying dust is infinitesimal. Small as the quantity is, however, flying dust, considered from the standpoint of public health, is an extremely important factor of the air, especially in large cities.

In order to carry on the study of flying dust, microscope slides may be exposed on sills about twelve feet from the ground. In the following experiments they were exposed from the sills of laboratory windows, on one side facing several hundred feet of lawn, on the other facing a much-traveled public highway. The slides on the sill facing the lawn faced also the prevailing northwesterly winds. The flying dust caught on these slides consisted mainly of soot from chimney stacks several miles away, the pollen of flowers, the scales of lepidopterous (scaly-winged) insects, the eggs of insects, the smut and similar parasitic growths on vegetation, meteoric iron, ash, earthy matter and various particles of unknown character. Slides exposed in rural sections of the country (all in Southern New York) gathered about the same kind of material, containing perhaps a greater variety of pollen, but less of chimney products. In regions where soft coal is extensively used, soot and other chimney products are the prevailing dust content of the atmosphere.

Flying Dust May Carry Disease. At all exposures facing public streets the earthy matter composing the surface of the street top dressing, together with horse manure, constitutes the bulk of the flying dust. In several instances, after the streets had been covered with tar, the daily catch of dust was reduced about ninety-five per cent, but the remaining catch consisted almost wholly of manure. Because of its lightness this material is easily carried by the wind—more easily, indeed, than earthy matter. It pervades the innermost recesses of dwellings—especially drawers and closets of rooms that face dusty streets. Wherever there are air currents they will carry dust of this character. Practically all food supplies, except those hermetically sealed, are plentifully besprinkled with it. Fortunately by the time it has been rain-soaked, dried and ground into fineness, it is comparatively harmless—more so, in all probability, than the garbage, putrescent matter and sputum that thrown upon street pavements, sooner or later find their way into the air as flying dust.

rule, the wind-blown dust from city and country roads is low-flying. Ex- in times of high winds, only a very roportion is carried higher than 100 d, fortunately, small insects such as ts in their winged stage, and mosqui- ely reach this altitude unless blown by the wind. Perhaps the dangers of uicable disease from wind-blown street re been exaggerated; certain it is, how- at dust is unpleasant and uncomfort- What is still more important is the t much of it is preventable. Tarring g dirt roads and washing hard-paved will reduce the amount of flying dust nimum. J.R.

H GUIANA, *ge ah'nah,* a tropical, only explored South American colony be- to the Netherlands. In 1667 it was the Dutch by England, in exchange Amsterdam, the present New York North of Guiana Atlantic on the he River jne, or divides it ench Gui- the west, er Coren- arates it itish Gui- d on the inaccessi- ntain for- livide it azil. Cov- a area of square is a little larger than Mississippi, but orted population of 86,100 in 1911, oes not, however, include negroes and of the forests, is only one-twentieth population of that American state. Guiana is sometimes called *Surinam,* chief river.

LOCATION MAP

The position of Dutch Guiana in the continent, showing the proportion of South America it occupies.

Land. The coastland of Dutch Guiana mangrove-covered swamp land, but in- portions are protected by dams and by narrow canals. The interior is inous and thickly forested. Numerous keep the land well watered, and the fertile, but only a small portion is un- tivation. The country's most impor- terway, the Surinam and its branches, drains central Dutch Guiana. About ten miles from the mouth of the Surinam lies Paramaribo, the capital, supporting nearly half the population of the country.

So hot and moist is the climate that, besides natives, the population consists chiefly of peoples of countries with similar conditions to combat—Indians, negroes, Chinese and Japanese. There are fewer than 1,000 Europeans.

COMPARATIVE AREAS

The text compares Dutch Guiana with Mississippi. Comparison with a northern state shows it to be about 600 square miles larger than the state of New York.

Resources. Sugar, cacao, bananas, rice, maize and coffee are grown, chiefly on plantations on coast lands and lower river courses. Those products furnish the principal wealth of the country, as the forests, though filled with trees of value, are still unexplored. Gold is found and mined, and the yearly output is estimated at over $400,000. The imports of Dutch Guiana, however, always exceed its exports.

Government and Religion. Executive powers are in the hands of a governor (assisted by a council of three members) and a vice-governor. The governor is president of the council; all are named by the sovereign of the Netherlands. The colonial assembly, or *states,* is the legislative body. Members of that body are chosen locally by electors, in the proportion of one for each 200 electors. Dutch Guiana is divided into thirteen districts and numerous communes. The official language is Dutch, but English is also used. Three cantonal courts, two circuit courts and a supreme court at the capital administer justice.

All religions are permitted; the people are mainly Mohammedans, Hindus, Moravian Brethren and Roman Catholics, there being but a small number of Lutherans and Jews.

History. Since 1667, when Dutch Guiana

became one of the Netherlands' possessions, it has been twice in England's power, from 1799 till 1802, and from 1804 to 1816. The most important event in its history since then was the abolition of slavery in 1863. The labor problem then became serious, and the agricultural industries of the country were almost ruined. No completely satisfactory solution was found, but at the end of the nineteenth century the Netherlands showed increased interest in the colony by establishing navigation service to Paramaribo. An experimental botanical garden has been established in that city to encourage agricultural activities. M.S.

DUTCHMAN'S BREECHES, *brich'es,* an odd springtime flower, whose lovely white blossoms tinged with creamy yellow hang in trembling clusters at the end of long, straight stalks, which shoot up directly from the root. From

DUTCHMAN'S BREECHES

four to eight of the dainty flowers are found in a cluster, while fine, lacelike leaves of a pale grayish-green color form a heavy foliage around them. The shape of the flower shows the origin of its humorous name, for the four petals are united in pairs, two of them forming a large double-spurred sac, and the other two, which are very small, forming a protection for the stigma. The roots are a collection of small solid tubers enclosed in a sheath, or scaly skin. The flowers may be found in bloom during April and May in rich, rocky woods from Nova Scotia to the Carolinas and as far west as Nebraska.

DUTIES, *du'tiz.* See TAX; CUSTOMS DUTIES.

DVORAK, *dvor'zhahk,* ANTONIN (1841-1904), a Bohemian musical composer, born in Mühlhausen, who began early in life to make a living with his compositions and by playing in small orchestras and in cafes. He grew up among Bohemian peasants, and he learned to love their folk songs so much that he embodied them in many of his finest themes. Not until he reached manhood was he enabled to have access to the compositions of Beethoven and Mendelssohn, and the study of their original scores induced him to try the larger forms and resulted in his composing a number of symphonies, operas, sacred compositions and some chamber music. But his best works, excepting the *Stabat Mater* and *Requiem Mass,* for which he is most renowned, are those which deal with national Bohemian folk themes.

For many years he made England the scene of his musical activities, and from 1892 to 1895 held the directorship of the New York National Conservatory. While in the United States he became intensely interested in the music of the negro and the Indian, and introduced their melodies into his symphony *From the New World* and into the overture *In Nature.* Despite the honors heaped upon him in Europe and in America, Dvorak remained to the end the simple man he always had been.

DWARF, a term generally applied to an unusually small human being or to plants and animals greatly below the average size of their species. From the very earliest times dwarfs have received great attention from the scientific world. Ancient kings paid great sums to obtain dwarfs as attendants. In the days of the Pharaohs expeditions were sent into the interior of Africa to procure dwarfs from among the Akka tribe of pygmies. Ptolemy Philadelphus was tutored by Philetas of Cos, grammarian and poet, who was so tiny that his shoes had to be weighted so that he might not be blown away. The Romans valued dwarfs very highly and sometimes adopted artificial means to stunt the growth of children. Julia, the niece of Augustus, was attended by two dwarfs, each twenty-eight inches in height. Jeffery Hudson, famous at the court of Charles I of England, was only eighteen inches high at the age of thirty. His stature eventually increased to thirty-nine inches, and he was so active and intelligent

that he became lēader of a cavalry regiment. When only eighteen inches in height he fought a duel with a man who had insulted him, and shot him dead.

In modern times dwarfs are in demand as exhibits. The public is apparently easily attracted by the abnormal, and giants, dwarfs and deformed persons arouse a good deal of morbid curiosity. The most famous dwarf of recent times was known as General Tom Thumb, so called after his prototype, who was supposed to have been a celebrity at the Round Table of King Arthur. There still exist in Central Africa several races of dwarfs perfectly formed, graceful in movement and intelligent. One who is a dwarf need not be mentally deficient. Among white races the dwarf is usually small because of bodily deformity.

DWIGHT, TIMOTHY (1752-1817), an American theologian and one of the ablest of the presidents of Yale College, was born in Northampton, Mass. His father was a merchant, and his mother was the daughter of the renowned Jonathan Edwards. He was graduated at Yale. During the Revolutionary War he was chaplain in the American army; at the close of the war he became principal and pastor of a boy's school in Greenfield, Conn., and in 1795 was chosen president of Yale College, remaining in that position until his death. His accession to the presidency of Yale marked a new era in the history of that institution, as at that time there were only about 100 students, one professor and three tutors, but he established permanent professorships and anticipated the growth of the college by purchasing additional ground. He also planned for the organization of professional schools with special faculties, but only the medical school had been established at the time of his death. His published writings total seven volumes, and consist chiefly of sermons and theological essays.

Timothy Dwight (1828-), a grandson of Timothy Dwight, a noted Greek and Biblical scholar, was born in Norwich, Conn. He was educated at Yale College and in Germany at Bonn and Berlin universities. From 1858 to 1886 he was professor of sacred literature and Greek at Yale, becoming president of the university in the latter year. At the time of his retirement as president in 1899 the student body numbered 2,500. Among his published works are *Memories of Yale Life and Men* and *Thoughts of the Inner Life*. He also annotated several Biblical commentaries and was a frequent contributor to periodicals.

DYAKS, *di'aks,* a race of brown people inhabiting the seacoast and parts of the interior of the island of Borneo. They are of greater stature than the Malays, though considerably shorter than the average white man. Their

A DYAK WOMAN

The clothing for the entire family is made by the women in the above laborious manner. The metal corselet has been a feature of female dress since before white men knew of the Dyaks' existence.

hair is long and straight, and is tied in a knot at the back of the head. Blackened teeth are considered a mark of beauty. Their mouths are generally ill-shaped and disfigured by excessive chewing of betel nut, a habit indulged in by both men and women (see BETEL, subhead *Betel Chewing*). A whole village, consisting of twenty to thirty families, lives together under one roof. This village house is built on piles of wood from six to twelve feet above the ground. Rice cultivation, cloth and mat weaving and boat building are the principal industries. Each family farms its own land.

Head-hunting, or killing human beings and securing their heads as trophies, was long practiced among all the Dyaks, but has been suppressed to a great extent where European influence obtains. In the old days no Dyak chief could be married unless he had been successful in procuring the head of an enemy. For this reason it was usual to make an expedition into an enemy's country before the marriage-feast of any great chief could be held. The head brought home need not be that of a man; a woman's or a child's would serve the purpose quite as well.

DYE'ING AND DYE'STUFFS. Dyeing is the art of permanently coloring textile fabrics and other materials. The term *dyestuffs* is applied to all chemicals and other products used to obtain the desired colors. Dyeing is one of the most ancient of arts. It was practiced in prehistoric times and reached a state of perfection centuries before the Christian Era. The ancient Egyptians employed materials and processes for dyeing similar to those now in operation. As early as 1000 B.C. the city of Tyre was noted for its purple dye, which has not been improved upon by the most modern scientific processes. Cloth dyed with the purple of Tyre was so valuable that the Emperor Diocletian issued an edict in A.D. 301 fixing the price of wool so dyed at $350 per pound. The Greeks and Romans were far behind the ancient Egyptians in knowledge of dyeing, but during the early wars with the barbarians of the north they appear to have altogether lost the art. Julius Caesar found the Britons well skilled in dyeing, using chiefly products of bark and wood.

Dyestuffs. Modern discoveries have to a great extent superseded natural dyestuffs, with the exception of indigo, and most of the commercial dyes are products of coal tar. Animal fabrics, such as wool and silk, are more readily dyed than vegetable products like cotton and flax. The coloring matter quickly adheres to wool and silk, after being prepared by cleaning for the application of the dye. Cotton will not take dye direct, and the coloring matter must be supplemented by some other substance, the action of which tends to make the cotton and the coloring matter combine. There are many substances, called *mordants,* which are used for this purpose. Those most commonly employed are alum, aluminum salts, salts of iron, tannin, albumen and gluten. Stuffs needing mordants are first plunged into a solution of mordant salts and then treated with ammonia, lime, sodium phosphate or sodium arsenate to render the salts insoluble. Then the stuffs are brought into contact with the dye, the resulting color being formed by the combination of the insoluble salts of the mordant with the coloring matter of the dye.

The apparatus used in dyeing is simple in construction, consisting of vats, kettles and cisterns of iron, wood or stone. The water used in washing the fabrics must be pure; any contamination tends to destroy the color effect. Wool, cotton and silk may be dyed before ing woven, or may be dyed in the piece after weaving. Mixtures of cotton and wool usually require two dyeing processes. The cotton is first treated, and the finished weave is brought to the required color by a dye that affects only the wool.

German Supremacy. The War of the Nations, which began in 1914, had a serious effect on the manufacture of fabrics in the United States and Canada, owing to the fact that the importation of dyestuffs from Germany, where their manufacture had reached the highest perfection, entirely ceased. Both North and South America had for years relied on Germany and Austria for many of the materials used in dyeing. The German chemists have long been recognized as supreme in this field, and American manufacturers had so far acknowledged this supremacy that home production had been almost entirely neglected. Thus out of dyestuffs valued at $7,118,528 produced in the United States in 1914, over $4,653,000 worth were coal-tar dyes, nearly one-half of which were merely mixtures made in the United States of artificial colors manufactured abroad. These figures include only the stuffs intended for sale; a number of establishments using dyes produced their own stuffs and were perhaps even more dependent upon foreign aid.

When the supply from Europe was cut off manufacturers were confronted by serious difficulties. Certain colors could not be produced without German dyestuffs. In one case it was necessary for one of Iowa's colleges to change its college colors, as they could not be produced in America. American chemists quickly discovered the secrets of many of the German processes, and produced dyes of good quality, showing conclusively that if the matter had been given earlier attention such utter dependence on the European supply would have been unnecessary. S.L.A.

Related Subjects. The following articles in these volumes contain information which will be of interest in connection with the general article on dyeing:

Alizarin	Indigo
Aniline	Mordants
Carmine	Sloe
Coal Tar	Turmeric
Cochineal	Woad

DYNAMICS, *di nam'iks,* from a Greek word meaning *power,* is that branch of physics which treats of the laws of force, or laws of motion. By force we mean that agency by which the rate of motion of a body is increased or decreased or its direction changed. All forces are subject to the same laws. Force is meas-

ured by its effect on a given mass, and two systems or units are used. These are the *foot-pound,* or *poundal* (which see) of the English system, and the *dyne* (which see) of the metric system. In English-speaking countries the metric system is generally used in physical laboratories, and the English system elsewhere. See PHYSICS.

The resistance which a body offers to a force is directly in proportion to its mass. That is, a body weighing four pounds will offer four times the resistance to a given force that a body weighing one pound will offer. This may be expressed in the following law:

The velocity produced in a body free to move without resistance in any unit of time will be directly proportional to the intensity or amount of the impressed force and inversely proportional to the mass of the body.

The science of dynamics is founded almost entirely on the following three principles, known as Newton's Laws of Motion:

(1) A body at rest remains at rest, and a body in motion moves with a uniform velocity in a straight line, unless acted upon by some external force.

(2) A given force will produce the same effect, whether acting upon a body in motion or at rest, whether the body is acted upon by that force alone or by others at the same time.

(3) The action of every force is accompanied by an equal reaction in the opposite direction.

DYNAMITE, *di'na mite,* a word derived from the Greek *dynamis,* meaning *power,* and applied to an explosive substance invented by A. Nobel in 1866. It consists of a mixture of nitroglycerine and some absorbent material such as infusorial earth, wood pulp, guncotton, or mixtures of such materials with nitrates, such as saltpeter. Nobel found that by soaking gunpowder in nitroglycerine an explosive of tremendous power was obtained. Since 1866 the processes for the preparation of dynamite have undergone many modifications. All experiments have been directed toward the production of a dynamite suitable for blasting purposes, combining power with comparative safety in handling.

The most powerful dynamite is now made in the form of gelatin consisting of cellulose nitrate dissolved in nitroglycerine. This is mixed with wood pulp and a little potassium nitrate. The result is a jelly which is easily handled and is suitable for blasting purposes in either dry or wet localities. For commercial purposes dynamite is put up in sticks, or cartridges, eight inches long and from one to three inches thick. The percentage of nitroglycerine varies according to the desired strength. The average dynamite for blasting contains forty per cent of nitroglycerine, but sometimes this is increased to seventy per cent. The dynamite is exploded by means of a fuse and a detonating cap of fulminate of mercury. The explosive force of dynamite is thirteen times as great as that of ordinary gunpowder. It ranks so far below more recently-discovered explosives, however, that except in combination it was little used in the War of the Nations, which began in 1914. See EXPLOSIVES. J.F.S.

DYNAMO, a machine that generates electricity for light, heat, power and other commercial purposes. The name comes from a Greek word meaning *power.* The three essential parts of a dynamo are the *field magnet,* the *armature* and the *commutator.* To understand the construction of a dynamo and the principle upon which it works, one must have some knowledge of electricity, magnetism and mechanics. A brief description to the non-technical mind can at best give an account of only the most important parts and their operation.

Principle of the Dynamo. The principle upon which the dynamo is built is that magnetism generates electricity, and electricity generates magnetism. If a steel bar magnet is thrust into the interior of a coil of wire, a

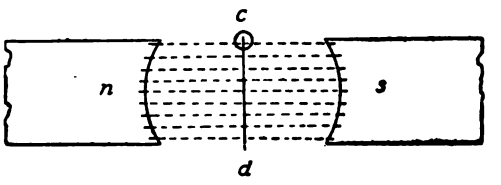


FIG. 1

current of electricity will be generated in the wire. The pressure of this current is greater at one end of the wire and the current will flow continuously in the direction of the least resistance so long as conditions remain unchanged; but if the magnet is turned half way round so as to reverse its poles, the current will flow in the opposite direction. In Fig. 1, *n* and *s* represent the poles of a magnet. The space between them is a field of magnetic force. The wire *c d* is placed at right angles to the lines of this force. If the wire is moved downward the current flows from *d* to *c;* if it is moved upward the current is from *c* to *d.* That is, every time the position of the wire changes in reference to the magnet, the direction of the current changes. If in place of the single wire we use a rectangular wire frame mounted on an axis

so that it can be rotated we shall secure two reversals of the current in the wire at each rotation (Fig. 2). If the ends of this wire are connected by leaders to a galvanometer (which see), this instrument will show that the strength

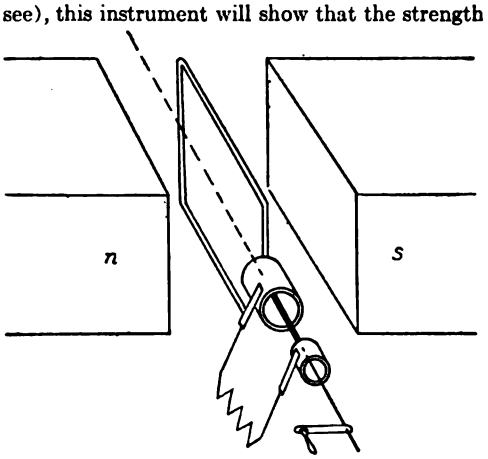


FIG. 2

of the current increases with the rapidity of rotation. Now the dynamo is constructed on this principle. An electro-magnet is used in place of a steel magnet because it can be made so much more powerful.

A Simple Dynamo. Fig. 3 shows a simple dynamo, and one that any ingenious boy can make with a few tools and the aid of a blacksmith. The part *e* is the electro-magnet, on which *n* and *s* represent the + and — poles; *f* is a rotating disk to which two other magnets are attached. This is mounted on the shaft *h*, which is belted from the pulley to a drive wheel. Two brushes, *a* and *b*, are connected with the two insulated copper strips, *r r*, and with the coils of *e* by the wires *l*, *m*.

Iron always possesses some magnetism, which is produced by the work done upon it in preparing it for use. Each magnet generates a current in the other. At first this current is very feeble, but it rapidly gains strength with the rotation of the revolving magnet. At each half revolution of the shaft the relative positions of these insulated copper strips are reversed, and at the same time the currents generated in the revolving magnet are reversed. They pass out by the brush *b* and re- through *a*, circulating in this direction ugh the external circuit and coils of the e, as shown by the arrows. The cur- in the revolving magnet is a ed current, and for this reason rnating current, but it is t or *continuous* current in the coils and external circuit of the permanent magnet.

Parts. The revolving magnet is the *armature*, the stationary magnet is the *magnetic field*, and the insulated pieces of copper form the *commutator*, because by them the alternating current is *commuted*, or changed, to a direct current.

The Commercial Dynamo. Dynamos are unipolar, bi-polar and multi-polar, according to the number of magnets in their magnetic field. Most of those in practical use are multi-polar, and contain as many magnets as can be used. The armature is usually a drum and revolves within the field magnet. The commutator is attached to the shaft of the armature, and brushes connect with the main-line wires.

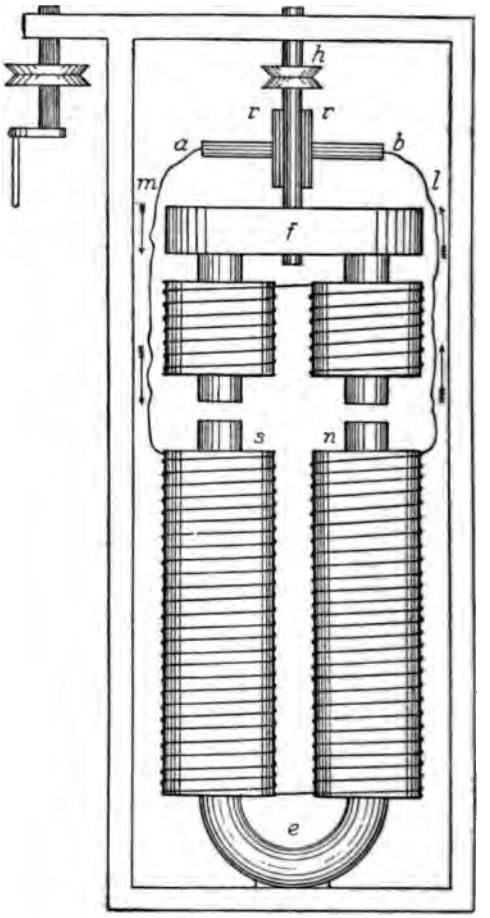


FIG. 3

Dynamos are of two general classes, *alternating current* and *direct current*, and there are many different patterns in each class, but all are based on the principle explained in the

simple dynamo. There are a number of methods of winding the armature and field magnet for the purpose of adapting the dynamo to a particular line of work. Large dynamos are operated by steam engines or by water power. In the best patterns the armature is attached to the shaft of the engine or the water wheel, as the case may be. The steam turbine (see article TURBINE) is used in place of the old-style steam engine in all large electric plants.

Dynamos of 12,000 horse power are in use in New York City. There are a number of 11,000 horse power at Keokuk, Iowa, and those at Niagara Falls are each of 5,000 horse power. Small dynamos from less than one-half horse power are used in small plants (see HORSE POWER).

Uses. The dynamo generates the electric current in use for all commercial and industrial purposes. It lights our streets and houses, bakes our bread, heats our flatirons and sometimes curls women's hair. It furnishes the power for all electric railways, and for operating the powerful machinery of the industrial world. Its invention has so completely changed our methods of manufacture and transportation that we cannot do without it. Without the dynamo the great telegraph and telephone systems of the present day would never have been developed, and wireless telegraphy would have been impossible. W.F.R.

Consult Houston's *The Boy Electrician;* Johnson's *Electricity and Electric Magic.*

Related Subjects. The reader is referred to the following articles in these volumes:

Current, Electric	Electric Light
Electricity	Electromagnetism

DYNE, *dine,* in physics, is a unit employed in measuring force. It is the force which, acting upon one gram of matter, will move it one centimeter per second. In the terms of common weights and measures a dyne is the force which acting upon 15.4 grains of matter will move that mass .3937 of an inch in one second. The dyne is in general use for measuring delicate electric force, but the unit is too small for ordinary purposes. For larger measurements the megadyne (1,000,000 dynes) and the kilogram (1,000,000 grains) are used. In physics the dyne is considered as the unit in the centimeter-gram-second (C. G. S.) system of units. See METRIC SYSTEM; DYNAMICS.

DYSPEPSIA, *dis pep'si a,* a term generally used to describe indigestion in any of its forms. The word is derived from the Greek *dus,* meaning *hard,* and *peptein,* meaning *to digest.* Dyspepsia may be caused by eating food which is not readily digestible, by overindulgence in any kind of food, by bolting the food, by eating too concentrated foods, by unbalanced diet or by irregularity of meals. Another frequent cause is found in bad teeth, which prevent proper mastication of food. The symptoms are many and varied. A feeling of weight in the stomach, flatulence, headache or drowsiness are common symptoms. It may be, and frequently is, accompanied by constipation. A cure can be effected only by removing the cause. Out-of-door exercise is of great importance, and plenty of sleep in a well-ventilated room is essential. Medicinal treatment is never so effective as careful self-management. Regular habits should be cultivated, and the stomach should never be overfilled by too hearty meals. It is essential that the food be thoroughly ground by the teeth and mixed with saliva before it leaves the mouth (see MASTICATION).

The advice of physicians, very difficult for most people to accept, is that one should stop eating a little before his appetite appears fully satisfied. Greasy foods, smoked or salted meats, salt fish, pastry and newly-made bread should be avoided. Hot or cold water should be partaken of freely on arising in the morning, and from one to two glasses of hot water should be drunk an hour or so before lunch and before dinner. No fluids should be drunk by the dyspeptic at meal time, and tea can well be dispensed with altogether.

Dyspepsia is frequently a symptom of disease in the abdomen elsewhere than in the stomach. W.A.E.

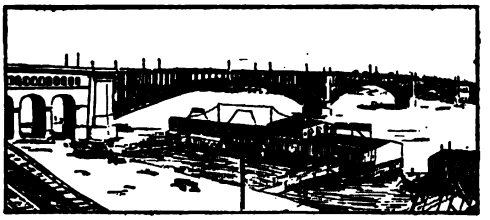
THE WORLD BOOK
ORGANIZED KNOWLEDGE IN STORY AND PICTURE

Ee

E, the fifth letter of the English alphabet and the one oftener used than any other. The Phoenician letter, which in form corresponded to it, represented a window and was an aspirate, such as expressed in the English *h*, but the Greeks made use of it as a vowel. They also turned it around from left to right, almost like the English capital letter *E*, which has come down from it. Like the letter *a*, it represents a number of sounds, the short sound being common in such words as *met, bless*. The long sound is the natural sound of the letter, as in *eve*. It was first in the fifteenth century that the final *e* in a word was not pronounced; it served and still serves to give the preceding vowel a long sound, as in *cane* or *mane*. The frequent use of the letter in English is largely due to its being the indefinite vowel into which the *a, o, u* endings of the Anglo-Saxon period were weakened. See ORTHOGRAPHY.

In music *E* is the third note in the natural scale of *C*. In the G clef *E* is on the first line and fourth space.

EADS, *eedz*, JAMES BUCHANAN (1820-1887), an American engineer who designed and constructed one of the finest bridges in the world, the *Eads Bridge*, arched over the Mississippi River at Saint Louis. He was born at Lawrenceburg, Ind., but at an early age went to Saint Louis and became a clerk on a steamboat. He invented a diving bell boat and an apparatus for raising sunken boats. Becoming famous as an authority on all matters relating to the navigation of the Mississippi, he was asked for advice by President Lincoln at the time of the War of Secession; the fleet of gunboats built on his suggestion rendered valuable service to the government, and with them Memphis was captured in 1862.



THE EADS BRIDGE

Among other improvements promoted by Eads along the Mississippi River, most notable is the construction of jetties (see JETTY) at the mouth of the Mississippi, permitting navigation by the largest ocean-going vessels. He was the first American to receive the Albert medal, conferred by the British Society for the encouragement of arts, manufactures and commerce.

The Eads Bridge is a three-span, steel-arched bridge connecting Saint Louis, Mo., and East Saint Louis, Ill. Four great piers standing on bed rock far below the river bottom support a bridge which accommodates two railways and a broad highway for street-cars, teams and pedestrians. This structure, erected without interfering with the river traffic, cost $6,500,000, about seven years' work and thirteen lives; but the difficulties encountered and overcome inspired men to inventions, ideas and methods of marked value to subsequent bridge engineering. It is not a free bridge, toll being required of all who use it, in the sums of twenty-five cents for persons on trains, ten cents for street-car passengers, and five cents for foot passengers. This great bridge was begun in 1867 and completed in 1874.

EAGLE, *e'g'l,* a general name for several species of birds of prey, widely distributed in both the eastern and western hemispheres. In the popular mind the name is associated with a bird of superb strength, keenness of sight

He clasps the crag with hookéd hands;
Close to the sun in lonely lands,
Ring'd with the azure world, he stands.
TENNYSON: *The Eagle.*

and marvelous powers of flight. This is the "bird of the broad and sweeping wing," as Percival describes it in his poem *To the Eagle*—a bird typical of strength and courage, which majestically soars higher than any other creature of the air and nests on mountain crags.

As a matter of fact, the different species of this group of birds vary considerably in size, appearance and characteristics, and not all of these deserve the halo of romance and poetry that has become so popularly associated with the name eagle. In general these birds possess a great powerful bill, with its upper part, or *mandible,* curved sharply down over the lower, toes with strong grasping power, and sharp, curved claws, or talons, used for seizing their prey. In most species the legs are feathered to the toes.

The Golden Eagle, a species common throughout mountainous and unsettled regions of North America, Europe, Asia and Northern Africa. It measures about seven feet from tip to tip of the expanded wings, and over three feet from beak to the end of the tail. Its body plumage is dusky brown, but the back of the head and the nape are pale yellow, whence its name, and the basal half of each tail feather and the feathers on the legs are white. Its favorite nesting place is a mountain tree or rocky cliff; the nests, some of which are fully five feet in diameter, contain two to three dull white eggs, which are often speckled or blotched with brown. This bird is a robber of lambs from the sheepfold, but is unjustly accused of carrying away young children to its distant eyrie. Called by some the *mountain eagle,* it is best known in Western North America as the *war eagle,* because its tail feathers are the favorite plumage for the Indians' war bonnets. These birds "grow gray with age," and may live a century.

The Bald Eagle, also known as the *Washington,* or *American, eagle,* is the one which has been chosen as the national emblem of the United States. The figure of this eagle is found on gold coins issued by the government. Its name has reference to the white head and neck of the mature bird. The year-old bird is dark brown; during the second year its plumage turns gray, and in the third year it becomes dusky brown, with head, neck and tail white, bill and feet yellow and the lower part of the legs bare of feathers. This eagle is particularly fond of fish and often robs the fishing osprey of its lawful prey. It feeds, too, on any small animals it can capture. Its habitat is the temperate regions of North America, and its favorite nesting place a tall tree near the water, though sometimes it nests on the rocky ledge of a high cliff. The eyrie is four or five feet in width, and is often as high as it is wide. The bald eagle lays two or three dull white eggs, somewhat like those of the golden eagle, but unblotched.

Other Species. Among other species in different parts of the world are the powerful *buzzard eagles,* the *Guiana eagles* of South America, and the huge *harpy eagles* of Brazilian forests. See HARPY; LAMMERGEIER. Compare, also, CONDOR. E.T.S.

Eagle (AS A STANDARD). Among the early Romans a gold figure of an eagle, symbol of strength and prowess, was placed on the tip end of a spear and carried as a standard at the head of a legion. Figures of animals were used, too, but in 104 B.C. the eagle became their chief emblem. Next to the lion, it became after the thirteenth century the favorite

device of knights and royalty on shields and armor. It was adopted by the German emperors, who claimed to be the successors of the Caesars. The double-headed eagle is used on the Russian and Austrian coats-of-arms, and in

THE EAGLE AS AN EMBLEM
In the center, the eagle of the Roman legions. At left, Austrian and Prussian symbols; at right, Russian and French.

1782 the United States adopted as its emblem the eagle with outspread wings, a shield on its breast, holding an olive branch and a sheaf of arrows in its talons. In the beak of the eagle in the American coat-of-arms is a scroll on which are the words *E Pluribus Unum,* the national motto of the American Union, meaning *from many, one.*

EAGLE. In the United States a gold coin worth ten dollars is issued by the government, and because it has the head of an eagle stamped on the back, the coin has been called an eagle. Its weight is 258 grains, nine-tenths pure gold. Eagles were first coined in 1795. Half-eagles, quarter-eagles and double-eagles are also coined. The value of the eagle and other gold pieces is the sum stamped on them, unless a considerable part of the gold is worn off by use, for the gold alone, without the added hardening metal, is of that value. See ALLOY; MONEY.

EAMES, *aymz,* EMMA, the stage name of EMMA HAYDEN STORY (1867-), an American soprano who has reached a high place in the world of grand opera. She was born in Shanghai, China, of American parents, and after the return of the family to America in 1872 her musical career was given careful attention. She studied in Boston and in Paris, and [redacted] 1889 made her début as Juliet at the [redacted]era, Paris, after which, in rôles such as Aïda, Elisabeth, Sieglinde and Santuzza, she gained remarkable success in all parts of the world. She married the artist, Julian Story, in 1891, but was divorced from him in 1907 and in 1911 married the baritone, Emilio de Gogorza.

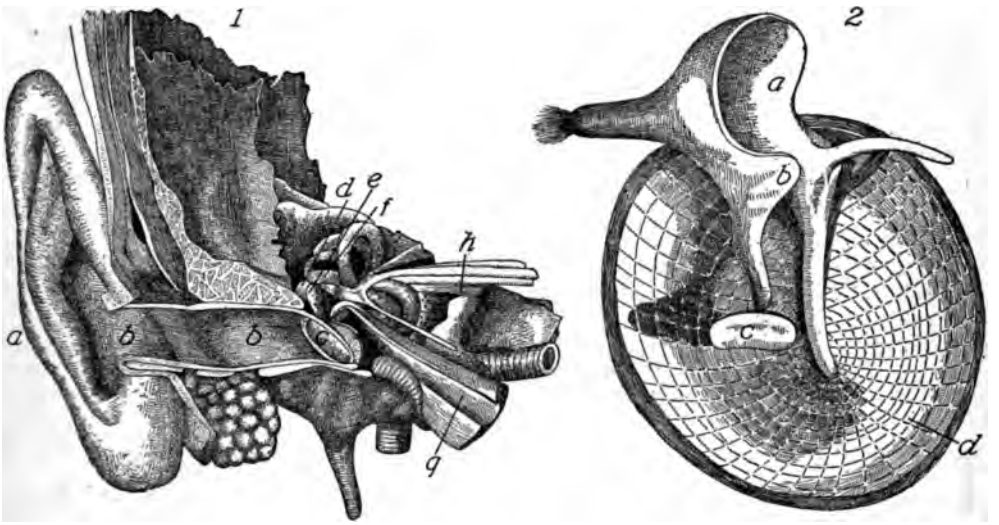
EAR, a device for receiving air vibrations that produce sound, and for transmitting them to the auditory nerve. The human ear is an example of perfection and delicacy of structure not surpassed elsewhere in the body. It consists of three parts, the *external ear,* the *middle ear* and the *internal ear.*

The External Ear. The external ear consists of two parts, the outer visible part, called the *auricle,* or *pinna,* and the *auditory canal,* a tube about one and one-fourth inches long, leading from the auricle to the membrane of the middle ear. The auricle, the part usually called the ear, is composed almost entirely of skin and cartilage, and, with rare exception, is stationary. Traces of muscles attached to the ear lead anatomists to believe that these muscles were once active and that there was a time in the development of the human race when man could move his ears to some extent to catch sound waves, as do horses and some other animals. The large hollow portion of the auricle, at the base of which is the opening into the auditory canal, is called the *concha,* from its fancied resemblance to a conch shell.

The Middle Ear, or Tympanum. The middle ear is a small cavity in the temporal bone, half an inch long and a quarter of an inch wide. In popular language it is known as the *drum cavity,* for its outer end is closed, like a drum, with a thin piece of membrane (*membrana tympani*). This membrane separates the drum cavity from the external ear, while a bony-membranous partition forms a common wall for the middle and inner ears. The middle ear is filled with air and lined with mucous membrane, and its cavity extends backward into a bony projection known as the *mastoid process.* Extending across the cavity from one membrane to the other is a chain of three small bones—the mallet (*malleus*), anvil (*incus*) and stirrup (*stapes*). See *a, b, c,* Fig. 2. The mallet consists of a head, neck and handle, the latter being attached to the inner surface of the drum membrane. The bones are so joined together that they strengthen the vibrations of the ear drum as they carry them forward to the internal ear.

The membrane of the tympanum is nearly circular and about two-thirds of the size of a

ten-cent piece. It is placed obliquely across the auditory canal, and consists of fine, fibrous tissue covered on the outer surface with a thin layer of modified skin and on the inner with a delicate mucous membrane. Air is admitted to the middle ear through the Eustachian tube, which opens into the throat behind the soft palate. Through the Eustachian tube an equal atmospheric pressure is maintained on each side of the drum membrane. Sometimes this balance is disturbed by forcing an extra bubble of air into the middle ear when one is coughing or sneezing; an uncomfortable sensation is then experienced, and the hearing is affected for a moment. Children often force air into the middle ear by holding the nose and closing the mouth and then trying to expel the breath. The practice should be discouraged, as it may cause injury to the ear drum. In the act of swallowing the tube is opened, allowing an interchange of air and adjustment of pressure. This fact is important for those who ascend in airships or go down in diving bells.



NAMES OF THE PARTS OF THE EAR

FIG. 1.
(*a*) Pinna, or auricle
(*b*) External auditory canal
(*c*) *Membrana tympani*
(*d*) Incus
(*e*) Malleus
(*f*) External semi-circular canal
(*g*) Eustachian tube
(*h*) Internal auditory canal

FIG. 2.
(*a*) Head of the malleus
(*b*) Incus
(*c*) Plate of the stapes
(*d*) Insertion of the *tensor tympani*

The Internal Ear, or Labyrinth. The internal ear is a cavity having the form of a three-sided pyramid, with walls and partitions of very hard, compact bone. Because of its numerous winding passages, it is often called the *labyrinth*. It consists of three parts, the *vestibule*, the *semicircular canals* and the *cochlea*.

The Vestibule. The vestibule is a small ovoid-shaped cavity between the cochlea and the semicircular canals. It is the center of the entire hearing apparatus. The base of the stirrup, or *stapes* bone, is set into an opening in the front wall, and there are openings in the other walls leading to each of the semicircular canals and to the cochlea. Through minute openings in its inner wall filaments of the auditory nerve enter.

The Cochlea. This little organ, shaped somewhat like a snail-shell, from which it takes its name, is situated in front of the vestibule. In its center is a bonelike column, around which a spiral canal winds two and a half turns. At the top this canal is closed, but at the bottom there are two openings, one of which leads to the vestibule.

Semicircular Canals. These are three in number; two are in a vertical position and one is horizontal. The vertical canals are placed at nearly right angles to each other, one being in a plane extending from front to back and the other one extending from side to side. It is now generally believed that these canals do not aid the sense of hearing, but that, strange as it may seem, their function is to enable a

person to keep his balance. Nerves extend from them to the cerebellum, communicating there with the nerves controlling the muscles that enable one to stand. Any movement which causes violent or unusual disturbance of the liquid in these canals leads to dizziness, which in turn may cause nausea. Seasickness is caused by this sort of disturbance.

The Membranous Labyrinth. Within the cavities of the internal ear and separated from the bone by a layer of liquid (*perilymph*) is a membranous sac which in form and size coincides almost exactly with them. To this the name *membranous labyrinth* has been applied. This sac is filled with fluid (*endolymph*) in which are found minute threadlike branches of the auditory nerve.

The Organ of Corti. The cochlea is divided into two parts, nearly equal in size, by what is known as the *basilar membrane.* Supported on this is a wonderful structure named, from its discoverer, the *organ of Corti.* It is formed

ONE TEST OF HEARING

This can be comparative only as between two or more people with the same watch. A maximum distance from ear to watch is not easy to suggest, for some watches tick more loudly than others. This test with any time-piece, however, will always demonstrate whether the hearing of one person is more acute than that of another.

of rods and cells which are continued with the basilar membrane throughout the extent of the cochlea. This organ and the membrane constitute a series of vibrating cords provided with nerve apparatus for receiving vibrations which are transmitted from the bones of the ear through the endolymph. These vibrations in turn are transformed into nervous impulses. The cords of the membrane are so adjusted that they can respond to vibrations which vary in rapidity from thirty to about 20,000 each second. The particular part that the organ of Corti plays in the process of hearing is further explained in the subhead below, *How We Hear.*

How We Hear. The act of hearing consists of two parts, one physical and the other mental. The apparatus which is described above *is for the physical* part. That for the mental part is found in the auditory centers of the brain, where the sound impressions conveyed by the auditory nerves are perceived and analyzed. To understand how the ear works, one must be acquainted with the laws of sound. These are explained in the article SOUND (which see). This article treats only of the reaction of the ear to sound waves.

A bell rings in an adjoining room. How do you hear it?

1. The tone sent forth is produced by vibrations in the metal of which the bell is made.
2. These vibrations set up vibrations, or waves, in the air, some of which enter the auditory canal and strike upon the drum membrane.
3. The waves striking upon the drum membrane set it to vibrating.
4. These vibrations are carried by the bones of the middle ear to the vestibule, where they set up vibrations in the fluid of the internal ear. The rods in the organ of Corti reproduce these vibrations and excite the auditory nerve, which carries the impression to the auditory centers of the brain.
5. The auditory centers react; that is, they bring the mind to bear on the impression they have received, and you hear the bell.

To obtain an illustration of the principle upon which the organ of Corti works, stand beside a piano with the lid open, and sing a clear, strong note; then listen, and you will hear the note reproduced by the piano. This is because some wire in the instrument produces the same number of vibrations per second as were produced by the voice. The other wires are silent because they cannot produce this same number of vibrations. The organ of Corti may be likened to a piano with many wires, each selecting the tone it can produce.

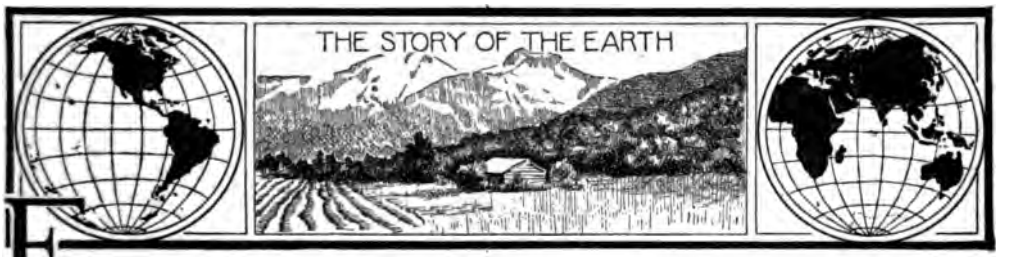
Care of the Ear. The skin of the auditory canal contains cells that pour into the canal a yellowish substance called *ear wax,* which has a very bitter taste. Its purpose is to protect the ear by catching any dirt that may get into the ear, and to repel insects. The wax dries and scales off and carries foreign substances with it. It should not be removed from the canal except when it accumulates in excess. The ear drum has a very delicate membrane, which is easily punctured or broken. A severe blow upon the ear may break this membrane and render the victim deaf for life; therefore "boxing the ears" of children is a dangerous punishment. Neither should one stick pens or pencils into the ear. It is safe to follow the old German proverb, "Never pick your ear with anything smaller than your elbow." Any foreign substance in the ear should be removed by a physician.

If the internal ear is injured or any part of it is destroyed there is no remedy, and this is also true of the auditory centers. Injury to any of these parts may render a person deaf. Consequently, earache, due to the formation of abscesses in or about the ear, should receive prompt attention from a physician. The ear is a most delicate organ and must be treated with care. See DEAF AND DUMB. J.H.K.

Consult Dench's *Diseases of the Ear;* Cunningham's *Text-book of Anatomy.*

EARL, *url,* the oldest title of nobility and third in rank in the British peerage, marquis and duke being more exalted titles. It was the highest title until the Black Prince was made Duke of Cornwall in 1337. The word is derived from the Scandinavian *jarl,* and was in use in England as early as the days of Canute. An earl is addressed verbally as "My Lord" and in writing as "The Right Honorable, the Earl of ———." An earl's wife is a *countess* and is addressed as "My Lady" and "Right Honorable." The eldest son is called *viscount* by courtesy, all younger sons being styled "Honorable." The daughter of an earl is entitled to have "Lady" prefixed to her Christian name.

EARLY, *ur'li,* JUBAL ANDERSON (1816-1894), a prominent Confederate general in the War of Secession, was born in Franklin County, Va. He was graduated at West Point in 1837 and was appointed lieutenant of artillery, but resigned in order to study and practice law, and was afterward elected to the Virginia legislature. He opposed secession of the Southern states of the American Union, but after Virginia joined the Confederacy he entered the army on the side of the South and rendered conspicuous service at the first Battle of Bull Run, soon after being promoted to the rank of brigadier-general and subsequently major-general. After Lee and Jackson, General Early was regarded as one of the ablest in the Confederate army. At the close of the war he went to Canada, but returned to the United States to resume the practice of law in 1867. For a time he was president of the Southern Historical Society. He died in Lynchburg, Va.



EARTH, *urth,* a member of the solar system, the planet inhabited by man, third among the planets in distance from the sun, Venus and Mercury being nearer. It is attended by one satellite, the moon. The component parts of the earth are a gaseous *atmosphere* enveloping the earth's crust; the solid surface, called the *lithosphere;* the surface waters, called oceans, or the *hydrosphere;* and the *centrosphere,* the interior, or nucleus, of the earth itself.

To account for the origin of the earth many theories have been advanced, both in ancient and in modern times. The best-known of the explanations offered by modern scientists is the nebular hypothesis of Kant and Laplace. The earth, according to this theory, is a part of a system which was originally a body of gaseous (nebulous) matter. Under the action of the force of gravity this matter tended to take a rotating globular form. As the mass gradually contracted parts of it were thrown off, one after another, forming the earth and the other planets. Likewise the rapid rotation of the planets caused portions of their masses to be thrown off, forming the satellites.

The nebular hypothesis is not, however, accepted by all scholars, and in fact is giving way to the newer *planetesimal hypothesis.* The scientists who accept this theory believe that nebulae consist of swarms of small bodies, many of which move in regular paths and are really tiny planets, whence the name planetesimal. It is supposed that some of these revolving bodies are brought so close to one another that they are gradually collected into a number of large, compact masses, heat and pressure combining to weld together the separate parts of these masses. Continuing to revolve around the central sun, they gather up other planetesimals and so form planets. The origin of our solar system and of others is

explained by this hypothesis, which, its sponsors say, overcomes various difficulties of the Laplace system.

Form of the Earth. Though in popular language the earth is said to be round, like a ball, it is really an irregular sphere, slightly flattened at the poles. For lack of a better word, geographers call it a *geoid;* this word is of Greek derivation and means *earthlike.* The slight departure from rotundity is accounted for by the rapid motion of the earth while in a more plastic state. Because of the flattening at the poles the diameter of the earth from pole to pole through the equator is shorter than that at the equator. The meter, the unit of linear measure in the French, or metric, system, is exactly one-ten-millionth of the distance from equator to pole.

The belief of the ancients concerning the shape of the earth is one that prevailed for many centuries before Columbus made his epoch-making voyage in 1492. Ancient people, as do primitive races of to-day, believed that the earth was a flat disk of land, floating on water beneath a huge inverted bowl of sky which met the water at a distance beyond the measurement of man. So persistently was this belief held that the first expedition of Columbus was considered by large numbers of people as not only ridiculous but highly dangerous; his vessels, they said, were sure to fall off the earth if they sailed far enough.

It is not true, however, that no one before the days of Columbus knew that the earth is round. That fact had been proved before the time of Aristotle (d. 322 B.C.), and Aristotle himself figured the circumference of the earth at 40,000 miles. A more accurate estimate was made by Eratosthenes, a Greek of Alexandria, in 200 B.C.; he figured it to be 25,000 miles, which is only 101 miles more than the exact distance. During the Middle Ages, however, the knowledge of the earth's rotundity seems to have been lost altogether; it was during the exploration era, which began in the closing years of the fifteenth century, that the fact was proved beyond all doubt and became a permanently-established principle of geography. The arguments that are advanced—the disappearance first of the hull of a vessel as it sails away from harbor, the appearance of the top mast first as it approaches harbor, the circular shadow thrown on the moon by the earth in times of [illegible]—have their culmination in the greatest [illegible] of all, that men have actually sailed [illegible] the earth.

Parts of the Earth. Returning to the division of the earth into its component parts, the first to be considered is *atmosphere,* or air. By means of atmosphere all plant and animal life is sustained, for both plants and animals breathe. The atmosphere envelops the globe in the form of an intangible, invisible outer covering. Its depth is not known, but we know that it is at least 100 miles, although at that height it is not at all dense. When people were first told that the earth is traveling through space at the enormous pace of 66,000 miles an hour in its journey round the sun, they believed that if that were true the world would run away from its air. They did not realize that the atmosphere was an integral part of the earth's system, enveloping it completely and traveling with it on its endless journey.

The atmosphere bears on the surface of the earth with a pressure equal to 14.7 pounds per square inch; that is, a column of air with a base of one square inch reaching as high as the atmosphere extends weighs 14.7 pounds. Its average thickness is believed to be about, as stated above, but it is so much denser near the earth that half its bulk is within two and one-half miles of the earth's surface. This is readily proved by those who ascend high mountains; the higher the climber goes the more rarefied and the lighter the air grows, until breathing becomes a matter of difficulty, as there is not enough density or weight in the atmosphere to satisfy the lungs. Aviators who fly at extreme heights suffer greatly from this cause.

The Solid Crust, or Lithosphere. Under the title lithosphere is to be considered the outer crust of the earth, the shell which encloses the nucleus of the earth. It is from this shell that we derive our means of sustenance, on which we grow crops, from which we extract gold, coal, iron, and other valuable commodities. It is estimated that the crust of the earth consists of a mass of solid matter whose volume is approximately 1,677,000,000 cubic miles. Such a mass is entirely beyond human comprehension, and worked out into tons would be represented by 210 followed by eighteen noughts. The average volume of the earth's crust has a density of 5.5 times that of water. The earth contains a great store of heat which, even in the outer crust, causes an increase in temperature in mines and wells of 1° F. for every sixty feet of descent. The depth to which the crust has been penetrated is com-

paratively slight, the deepest mine in the world not exceeding 6,000 feet, a little over a mile. This depth, however, is sufficient to raise the temperature almost beyond the point of human endurance. Scientific ventilation counteracts the increase in heat and renders it safe for men to work even at such a depth.

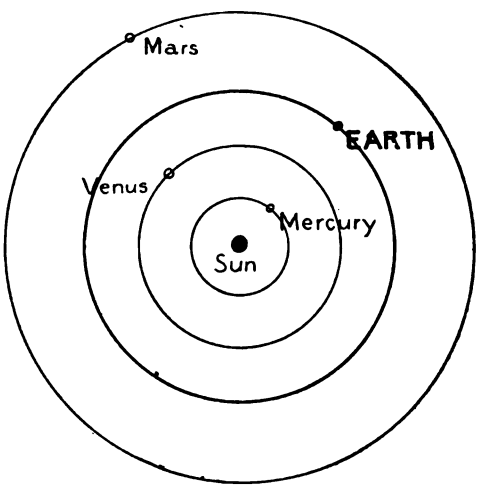
The Oceans, or Hydrosphere. About three-fourths of the earth's surface is covered by water—oceans and seas. The average depth of the oceans is about two miles; thus the volume of the oceans is 315,000,000 cubic miles. This is about $\frac{1}{800}$ part of the entire volume of the earth. The earth's crust, covering the earth to a depth of several miles, and of greater density, has a mass of about fourteen times that of the oceans.

The Earth's Interior, or Centrosphere. As to what the center, or nucleus, of the earth is composed of, opinions vary; scientists have brought forth many theories. One thing clearly established is that the density of the interior, or core, of the earth is greater than that of the earth's crust which rests on it. Some scientists maintain that the center of the earth is a molten mass, while others claim that this cannot be true, as the pressure of the crust on the nucleus, or center, is so great that heat far above the ordinary melting point can be resisted under such pressure. Increase the pressure on iron and the temperature of the melting point rises; thus, it is argued, the interior of the earth may hold sufficient heat to melt any metal at the surface, but not sufficient to melt it under the pressure of countless millions of tons of the earth's crust. An eminent English scientist maintains that the earth is solid throughout, rigid, but containing gaseous outlets or flaws here and there which, by reducing pressure, permit volcanic escapes and melting of matter which under pressure has remained solid. From the amount of pressure it is probable that such flaws cannot exist at a depth of more than a few miles; so the theory of an entirely solid nucleus finds wide acceptance among scientists.

The heat from the center of the earth continually escapes through the crust in appreciable quantities. It is estimated that the escaping heat would be sufficient to melt a coating of one-fourth inch of ice all over the world, or 800 cubic miles of ice every year. That the earth is shrinking as this heat escapes is a theory advanced by many scientists, but it would take thousands of millions of years to shrink to any appreciable extent.

Weight of the Earth. Archimedes, the famous Greek mathematician, was so proud of his invention of the lever that he exclaimed, "Give me a place to stand on, and I will lift the earth." At first thought, the task of the man who would undertake to weigh the earth would appear to be hopeless. Yet the earth has been weighed, not by putting it in the scales, but by scientific calculations which are equally certain in their results. The first calculations of the earth's weight were made by observing how much the attraction of a mountain caused a plummet to vary. The mountain could be measured and the weight calculated. From the proportion of the mass of the mountain to the earth, the weight of the earth was calculated, the result being expressed in figures absolutely beyond human comprehension. The figures in the table at the end of this article accord with scientific belief.

Motions of the Earth. *The Annual Revolution.* In common with all planets belonging to the solar system the earth moves round the sun and rotates on its own axis at the same time. Its revolution round the sun is completed in about 365¼ days, our common year; the precise time is 365 days, 9 hours, 9 minutes, 9.3 seconds, this time being known as the *sidereal* year. The path of the earth being an ellipse, with the sun as one of its foci (see Focus), the globe is not equally distant from the sun at all times of the year. Its least distance from the sun is 89,897,000 miles; its greatest distance, 92,963,000, generally expressed in round numbers as about 93 millions of miles. The earth travels around the sun at a speed



Orbit of the earth and of the three other "inner planets."

of about nineteen miles per second; so smooth is the motion through space and so slight are the variations of the earth's surface in proportion to its mass that no billiard ball has ever yet been made with less proportionate deviation from perfectly "true" motion.

The earth is nearest to the sun when it is winter in the northern hemisphere; when it is summer, farthest away from it. This at first appears improbable, yet it is true. It is not the distance from the sun that produces cold; the oblique direction of the sun's rays in winter, due to inclination of the earth's axis, prevents the radiation of heat over the northern surface. From the earth it appears as though the sun were also describing a similar circular path through the heavens. Hence it is that one group of stars is found near the sun at one time, and another group is near it at another date. The earth's position and point of view have changed, however, for the sun remains stationary.

Daily Rotation of the Earth. In 23 hours, 56 minutes, 4.1 seconds the earth makes a complete rotation on its own axis, this axis being inclined to the plane of its path about the sun at an angle of 23½°. In this rotation on the axis a person at either Pole would not move, but at the equator he would be whirled safely through space at the rate of about 1,000 miles per hour, for the equatorial circumference is nearly 25,000 miles. The motion of the earth causes the sun apparently to rise towards the North Pole from March 21 to June 21, until it is 23½° above the equator; to descend towards the equator from June 21 to September 21; then it commences to sink toward the South Pole, and to return to the equator about March 21, the vernal equinox.

This apparent motion of the sun, in reality the motion of the earth, is the cause of the changes in seasons, the lengths of day and night and the rising and setting of the sun. Countries lying north or south of the equator have equal days and nights twice a year, at the equinox. The earth is divided by imaginary lines into climatic zones, or regions. Within the limits of 23½° of the North and South poles are the *Arctic* and *Antarctic* circles; within 23½° on each side of the equator lie the tropics of Cancer and Capricorn, embracing the *torrid zone*. Between the tropics and [illegible] circles lie the north and south *temperate zones*, the area of the world's culture [illegible] wherein all man's greatness [illegible]d.

The Earth as a Clock. No mechanical appliance for time-keeping has yet been invented which can compete with the earth in the unfailing regularity of its motions. Although the earth is subject to influence of gravity from the other planets which might cause variation, such a change has never been noted to any appreciable extent, and it would take probably more than twenty centuries to alter the time-keeping qualities of the earth sufficiently to attain a result capable of expression in fractions of a second. Such is the poetic "harmony of the spheres."

At exactly the noon hour, when the sun is on the meridian at Greenwich Observatory, the time is flashed all over Europe; in Washington the time ball falls at the instant of noon from the tower of the naval observatory, and the telegraph announces the time.

Magnetism. One of the most striking features presented by the earth as a whole is its magnetism. The earth is one huge magnet and has two magnetic poles, which, although near the geographical poles, do not coincide with them. The north magnetic pole was located in 1905. The action of the earth as a magnet is seen when a magnetic needle, balanced on a point, remains in one position, pointing nearly due north and south. On this principle the compass, which renders world navigation possible, is based.

Some Computations. Scientists agree quite well, in spite of the immensity of their task, on certain mathematical facts relating to the earth. The circumference and diameter are known and measured with astronomical instruments to within less than one-fourth of a mile. One proof that the earth is slightly flattened at the poles is that at Edinburgh, Scotland, a degree is longer than in the vicinity of Madras.

Diameter of earth at equator (miles)	7,926.592
Diameter through the poles (miles)	7,899.739
Circumference at equator (miles)	24,899.00
Area of land surface (square miles)	55,641,102.
Area of oceans and seas (square miles)	141,333,882.
Total of the earth's surface (square miles)	196,974,984.
Weight of earth and atmosphere (tons)	3,333,112,909,800,000,000.
Proportionate density of water and solid matter	1 to 5.5
Nearest approach to the sun (miles)	89,897,000.
Farthest distance from the sun (miles)	92,963,000.
Length of a degree of latitude at poles (miles)	69.407

Length of a degree of latitude at equator (miles) 68.704
Cubic contents of earth (cubic miles) ..... 259,914,035,515.

J.R.

Consult Reade's *The Evolution of Earth Structure;* Bonney's *The Story of Our Planet.*

Related Subjects. For age of the earth, see GEOLOGY; for manner of reckoning time, LONGITUDE AND TIME; for relation to other planets, SOLAR SYSTEM and ASTRONOMY. The article GEOGRAPHY with its list of related subjects may also be consulted, and the following topics will be found especially helpful:

Air	Latitude
Antarctic Circle	Longitude
Apsides	Meridian
Arctic Circle	Moon
Axis	Nebular Hypothesis
Chart	Ocean
Climate	Oceanography
Degree	Perigee
Earth Currents	Physical Geography
Earthquake	Pole
Ecliptic	Sky
Equator	Solstice
Equinox	Tides
Globe	Tropics
Gravitation	Zodiac
Hemisphere	Zone
Hydrography	

EARTH CUR'RENTS. It has been found that telegraph lines in which the circuit is completed by the earth are traversed by natural electric currents which sometimes become strong enough to interfere with the proper working of the line. These currents have been named *earth currents.* The earth currents are always connected with magnetic disturbances in the earth, and when they are strong they are accompanied by brilliant appearances of the aurora borealis. The view which is now generally accepted by men of science is that both the earth currents and the magnetic disturbances are caused by electric currents in the upper regions of the atmosphere, and that these currents are also responsible for the appearance of the aurora borealis. See MAGNETISM; AURORA BOREALIS.

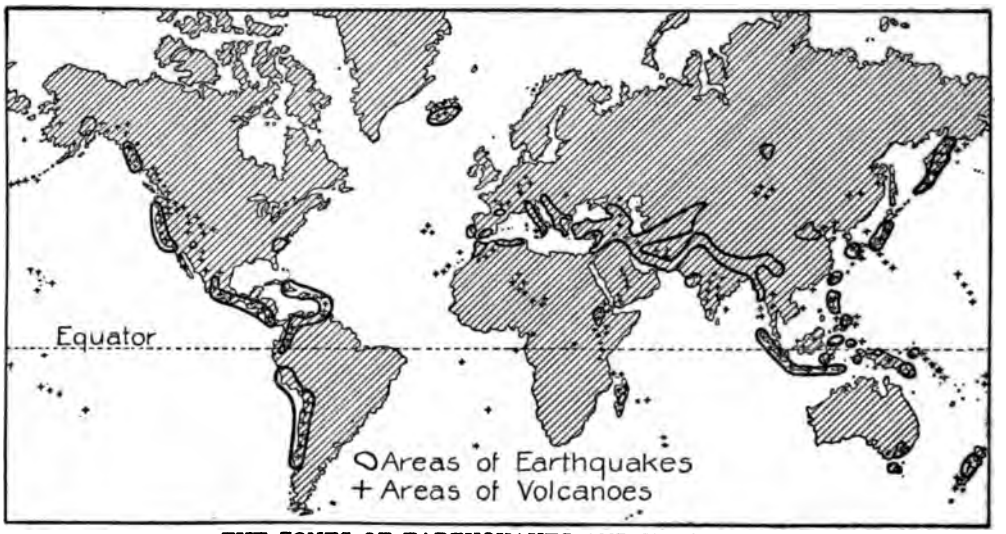
EARTH'QUAKE, a shaking of the ground caused by disturbances within the earth, is a phenomenon about which there is little scientific knowledge. Only within the last three-quarters of a century has there been systematic study of the causes, characteristics and effects of earthquakes. (More about this study, called *seismology,* will be found in the article SEISMOGRAPH.)

Earthquakes are in some places more frequent than storms. In Japan, between 1885 and 1892, about three shocks a day were recorded. Most earthquakes are perceived only with the aid of a detecting and recording instrument, the *seismograph.* When they are violent, the damage is never great unless densely-populated regions are affected; even then it is often due more to resulting fire or waves from the sea than to the shaking of the earth itself. At San Francisco, in 1906, fire was the chief destroyer; at Lisbon, in 1755, the sea.

An earthquake travels through the ground in waves usually but a very small fraction of an inch in width. Waves with a motion up and down of half an inch, or of an inch to and fro, are destructive. In soft land made by rivers or by man, they grow larger; thus at Valparaiso, Chile, in 1906, steel frame buildings on made land collapsed, while ordinary houses built on rock suffered but slightly. Following the example of Japanese seismologists, engineers are learning to construct buildings and bridges capable of withstanding earthquake waves of the usual intensity. One quake in Japan, however, is claimed to have had a wave movement of nearly a foot, which no practical type of building could withstand. Quakes under the sea, of which there are many, produce waves of water too small to wreak damage unless they reach shallow water, where they sometimes roll to a height of thirty or forty feet.

Causes. Most earthquakes are believed the result of changes in the earth's crust, usually the extension of old or the formation of new faults (see FAULT). After the California earthquake of 1906 it was found that along a previously-known fault nearly 300 miles long the strata had shifted horizontally from seven to twenty-one feet, and vertically from one to three feet. The usual points of origin for the disturbance are estimated to be from ten to twenty miles beneath the surface. A second class of shocks is ascribed to volcanoes. Its waves travel only a few miles, while those from the first variety sometimes extend around the world. A few minor earthquakes are thought to be due to the collapse of the underground caves.

The accompanying map shows that nearly all the great earthquake regions are in volcanic areas. Some scientists infer from this a common origin for the two, namely, the explosion of steam generated in the interior of the earth through the overheating of rocks containing water. But because the majority of the earthquake regions are those particularly liable to shifting strata—lofty ranges, as the Himalayas,



THE ZONES OF EARTHQUAKES AND VOLCANOES

or where mountains rise almost directly out of a deep sea, as on the west coast of the two Americas—most scientists prefer the theory of fracture and faults. But for these last there seems to be no logical explanation, unless it be the constant shrinkage of the earth's crust from cooling of the core beneath. As a matter of fact, the most severe shocks occur in young mountain ranges, as these are commonly regions of uplift. This is true in the Western Highland region of the American continent and also of the chain of islands off the east coast of the Asian continent. Earthquakes are about as frequent in the Appalachian highlands and the Atlantic coast region as in the Pacific coast region, but they are so feeble that one rarely feels the shock.

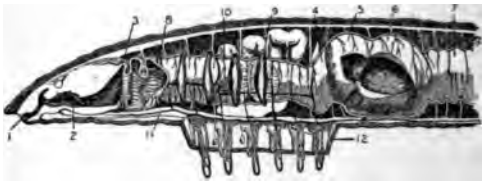
Seismology. Besides a better knowledge of how to build in affected areas, the benefits hoped for from the scientific study of earthquakes are a means of foretelling them and an acquaintance with those portions of the sea to be avoided in laying submarine cables. As most great shocks are preceded a few days earlier by minor shocks, the first task does not seem impossible.

Great Earthquakes. Following is a list of the most violent earthquakes of recent times, arranged in order of their destructiveness:

Messina, 1908; 76,483 lost, city destroyed
Calabria and Sicily, 1783; 60,000 lost
Lisbon, 1755; 40,000 lost, huge sea wave
Charleston, 1886; most of city destroyed
Kangra, India, 1905; 20,000 lost
Valparaiso, Chile, 1906; great havoc from fire
Kingston, Jamaica, 1907; wave and fire
San Francisco, 1906; city swept by fire
Assam, 1897; a very severe shock in an unpopulated area. J.R.

Consult Russell's *Volcanoes of North America.*

EARTH'WORM, ANGLEWORM, or **FISH-WORM,** a creeping, shiny-skinned, light red-brown worm, popularly known as a favorite bait for the fisherman. How many know, however, its value in the wonderful workings of



CROSS SECTION OF AN EARTHWORM

1. Mouth
2. Pharynx
3. Beginning of oesophagus
4. End of oesophagus
5. Crop
6. Gizzard
7. Intestine
8. First heart
9. Second heart
10. Lateral blood vessel
11. Ventral blood vessel
12. Body wall

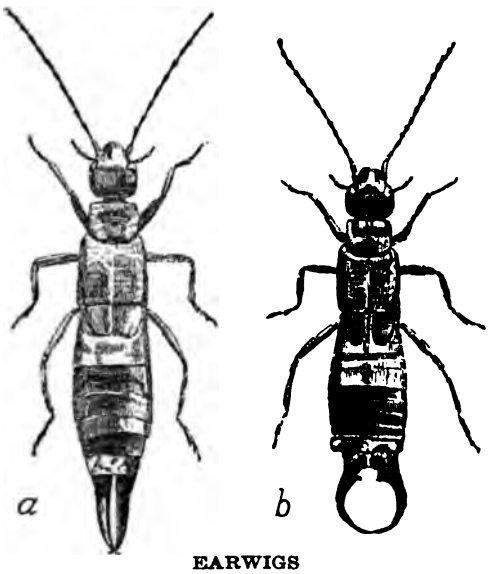
nature? The burrows it makes in the soil where it lives admit air and rain to the earth and make it more mellow, and those same burrows make convenient paths for the little roots of valuable plants.

Darwin says, "The plough is one of the most ancient and most valuable of man's inventions; but long before he existed the land was in fact regularly ploughed, and still continues to be thus ploughed, by earthworms." They reduce irregularities, and eventually bury stones and other objects; and by depositing little heaps of digested food on the surface of the earth add about one-fiftieth of an inch annually to the soil.

The earthworm belongs to the group of true worms; it is a worm which never changes into a beautiful butterfly, moth or miller, as do some so-called worms, but which, from the time of hatching from the egg, is always a cylindrical animal, with body of many segments, an animal which cannot see or hear, yet which has a nervous system sensitive to light and odor. The earthworm feeds at night on vegetable and animal matter, and it has been discovered that it is especially fond of cabbage, celery, raw fat meat and onions. Nearly 1,000 species are found, in all but the coldest and driest regions of the earth. They range from one-twenty-fifth of an inch in length to as much as three yards. They move by means of a double row of bristles on the under side of the body, and by contractions by means of two sets of muscles, one lengthwise of, the other circling around, the body. Their eggs are laid in a hard capsule about the size of a mustard seed; some of these are eaten by the young which hatch from others. Earthworms need moisture and die if through circumstances they are left on dry, hard substances from which they cannot escape. M.S.

Consult Beddard's *Earthworms and Their Allies;* Sedgwick and Wilson's *Biology,* chapter on "Earthworms."

EAR'WIG, the popular name for a group of beetlelike insects. They received this name



EARWIGS

(*a*) Female; (*b*) male. About five times natural size.

because it was believed that they creep into the ears of sleeping persons. Although the destruction of fruit and flowers has been attributed to earwigs, they are, on the other hand, really helpful in the destruction of thrips, snails and caterpillars, on which they feed at night. Their upper wings are short and leathery, the lower ones are gauzelike. Their feelers (antennae) are long and delicate. On the abdomen is a strong pair of pincers, the use for which has not been discovered. Earwigs are found under stones, in decayed bark of trees and in moist places in parts of most European countries. In the United States they are found only in the Southern states and on the Pacific coast. Several small, many-legged insects (centipedes) are also called earwigs in the United States. See CENTIPEDE.

EASEMENT, *ees'ment,* a legal term, meaning an acquired right which the owner of one piece of land has to the use and enjoyment for a particular purpose of adjoining land which belongs to another person. Easement rights are not numerous, but they include such well-known rights as the right of way, the right of having access to air and light, the right to maintain drains or dams or aqueducts upon an adjoining property. Easements are rights belonging to the land and are alienable or inheritable with the land. An easement may arise either by grant, by prescription (that is, by immemorial usage), by implication, or by necessity. The last-named arises when, for instance, one buys a piece of land or premises that are shut off on all sides from access to the highway. There is a reasonable presumption that the owner of the landlocked lot intended to convey to the buyer the right of way over his remaining land.

EAST CHICAGO, IND., in Lake County, is a manufacturing city on the southwestern shore of Lake Michigan, nineteen miles south and east of the business center of Chicago. It is in what is known as the Calumet region, which is rapidly developing into one vast industrial city. East Chicago is joined on the west, south and east by Whiting, Hammond and Gary, among which there is an interchange of labor and trade regardless of city boundary lines. The population of this entire community is approximately 100,000. The population of East Chicago in 1910 was 19,098 and in 1916 it was 28,743. About eighteen per cent of the inhabitants are Americans, thirty per cent are Poles, twelve per cent are Hungarians, and the remainder are of almost every other nationality.

East Chicago is on the main lines of the

New York Central, the Pennsylvania, the Baltimore & Ohio, the Wabash, the Pere Marquette and the Chicago, Lake Shore & South Bend railroads. Three belt roads connect with every railroad entering Chicago. Three electric lines extend to Chicago. The Indiana Harbor ship canal, crossed by a number of bascule bridges, extends from a harbor 300 feet wide and twenty-two feet deep, protected by a modern rubble breakwater, south from Lake Michigan to the Calumet River.

The unsurpassed shipping and transportation facilities of East Chicago have made it a center of iron and steel manufactories, which produce almost every kind of article from a bolt to a locomotive. Other important manufactures are foundry products, cement, lumber, boilers, chemicals, fire brick, soap, liquid air, conduits, hay and cotton presses and automobile trucks, the total annual value of manufactured products being over $41,000,000. The city has a city hall erected in 1907 at a cost of $58,500, two Carnegie libraries and six banks. In 1917 a movement was inaugurated to join the city with Gary and Indiana Harbor into one great city, under the commission form of government. E.C.MC C.

EASTER, *ees'ter.* When life is slowly bursting forth anew in springtime in woods, in parks, in gardens—when, as George Macdonald says, in his *Songs of the Spring Days,*

> The holy spirit of the Spring
> Is working silently,

—then comes the holy festival called Easter, observed in many branches of the Christian Church to commemorate the resurrection of Christ.

Many customs, beautiful and quaint, have been and still are observed in churches and in homes as an expression of joy because Christ rose from the dead. Churches have special services for this closing of the forty days of Lent (which see), and flowers of white, especially Easter lilies, decorate the altars as a sign of purity and light. The sending of Easter eggs is a custom thought to have originated with the Persians, the eggs being symbols of new life. Coloring them red symbolizes the blood of redemption; other colors have no special significance.

The name Easter comes from the Anglo-Saxon *Eostre,* a goddess of light or spring whose festival was celebrated in April. The name of the festival in Greek, French, Italian and most other languages is taken from the [illegible]ew *pesach,* meaning *passover,* as by the

Suggestive Programs for Easter

I think of the garden after the rain;
And hope to my heart comes singing,
"At morn the cherry blooms will be white,
And the Easter bells be ringing."
Procter

I

Song, *"Come, ye saints"*.....*Kelly*
Reading, The First Easter, *Luke* XXIV
The Easter Flower.....*Phillips Brooks*
Essay, *What the Name "Easter" Means*
Nature's Easter Music.....*Lucy Larcom*
Essay, *The Easter Lily*
The Song of the Lilies...*Lucy Wheelock*
Essay, *Signs of New Life in Nature*
How the Date for Easter Is Determined
The Voice of Spring.....*Hemans*
Essay, *How the Butterfly Symbolizes the Easter Lesson*
The Spring Is Here..... ..*Bryant*
The Year's at the Spring.....*Browning*

II

Song, *Christ the Lord Is Risen To-day* .....*Wesley*
Essay, *The True Significance of Easter*
The Lily of the Resurrection..... .....*Lucy Larcom*
The First Easter, *John* XX, 1-18
At Easter Time.....*Lucy Wheelock*
Essay, *The Easter Lesson as Shown by a Bulb*
Spring .....*Longfellow*
Essay, *How We Observe Easter*
Essay, *How the Ancients Accounted for the New Life in Nature*—the Story of Proserpina
Essay, *The Return of the Birds*
April .....*Whittier*

first Christians it was considered a continuation of the feast of the Passover at which the paschal lamb, symbol of Christ, was sacrificed.

The Annual Date. The proper time for celebrating Easter was long in dispute in the Christian Church. The Christians of the East first held Easter on the fourteenth of Nisan (corresponding to April), the day on which the Jewish Passover fell (see PASSOVER). The majority of the Church, however, celebrated it on the Sunday after that day. Finally the Council of Nice, in A. D. 325, fixed Easter as Sunday, the first one after the full moon which appears on or next after March 21. By "full moon" is meant the fourteenth day of the calendar moon. If the moon is full March 21, and should that day be Saturday, March 22 would be Easter; that is the earliest date on which it could fall. The latest date for Easter would be April 25; that would be the date if the moon should full on Monday, March 20. M.S.

EASTER LILY, a fragrant, trumpet-shaped flower of waxy whiteness. It stands out horizontally on stately stems from a background of abundant foliage, and not only graces church

THE EASTER LILY

O Risen Christ! O Easter Flower!
How dear Thy Grace has grown!
From East to West, with loving power,
Make all the world Thine own.
PHILLIPS BROOKS: *The Easter Flower.*

altars at Easter time but decorates the monuments of soldiers on Memorial Day and lends its beauty to Christmas festivals.

Until early in the nineteenth century the Madonna lily of Southern Europe was used by American florists for the Easter lily. But its blooming was so uncertain, blossoms often not appearing until several weeks after Easter, that new species were introduced from China, Japan and Bermuda. The Japanese and Chinese species, when grown in the open ground, bloom later than the Bermuda variety, their flowers appearing in June or July. Raised in hothouses, however, they can be forced for Easter blooming, and the flowers are more substantial than those of the Bermuda lily.

It will be noticed that Easter lilies offered by florists are usually without anthers and often without stamens. Those parts of the flower are removed to keep the blossom white and free from pollen; fertilization being prevented, the flower lives longer than otherwise would be the case.

EASTHAMPTON, MASS., a manufacturing town in Hampshire County, situated southwest of the geographical center of the state, four and one-half miles southwest of Northampton. The New York, New Haven & Hartford and the Boston & Maine railways provide transportation service, and trolley lines extend north and south. The first settlement was made in 1665; it was incorporated as a district in 1785 and as a town in 1809. In 1916 the population was 10,360, an increase of 1,836 since 1910. The area exceeds fourteen square miles.

Easthampton is engaged in making buttons, rubber and electric goods, drop forgings, cotton goods and yarns, and has one of the largest dyeing and mercerizing plants in the United States. Beside its public schools and library the town has Williston Seminary, one of the oldest preparatory schools for boys in New England. This school was founded in 1841 by Samuel and Emily Graves Williston, who built up in Easthampton the industry of covering buttons with cloth. J.B.

EAST IN'DIA COMPANY, a trading company formed in 1590 in London and given by the British government what was practically a monopoly of the trade with India and the East. The first charter, granted by Queen Elizabeth, conferred on it sole rights of trading in the countries specified, for a term of fifteen years. The company was by no means rich, for at first the stockholders advanced money to defray the expenses of the voyages, which were not very successful. James I renewed the charter, and the company was reorganized with a capital of $2,000,000, which was later increased to $6,000,000. Under the new charter, the company not only had exclusive trading rights, but was empowered to seize and confiscate ships and goods of other traders of any nationality.

From the point of view of trading and devel-

oping commerce, the company performed services that were of benefit to the world. Political rights were soon assumed, however, and the agents of the company not only interfered in Indian affairs, but, in the vicinity of their trading posts, endeavored to direct them. The French also were strongly established in the Eastern market; clashes between the employees of the East India Company and French companies were frequent, and these eventually led to open warfare. The troops organized by the British company defeated the French and their native allies and finally Clive, by his victory at Plassey, laid the foundation of a great Indian empire.

Trade with India was thrown open to all British subjects in 1813. The company retained exclusive rights to the Chinese trade, but the king was empowered to direct their political and legislative activities in India. In 1857 the company found itself unable to cope with the terrible Sepoy Rebellion (which see), and the affairs of India were placed in the hands of the British government.

The East India Company served the world as pioneers and blazed the trails to new fields of commerce. By them the wealth of the Indies was revealed, and the eyes of the commercial world were turned Eastward. It might be said that, indirectly, the East India Company was responsible for the building of the Suez Canal, as its traders were among the first to point out the great advantages to be reaped by quicker routes for trading with India and the Far East. F.ST.A.

EAST INDIES, *in'diz,* in its broadest sense the name applied to the southeastern part of Asia, including India, the Malay Peninsula and the islands of the Malay Archipelago, together with the Philippine Islands. It is customary to speak of the islands of this region as the *East India Islands,* and the Dutch possessions of the Malay Archipelago as the *Dutch East Indies.* The name *Indies* originated in the fifteenth century, and it was in an effort to find a shorter route to these lands that Columbus discovered America. Believing the newly-discovered islands of the western hemisphere to be the extreme western parts of the Indian region, the name *Indies* was given to them. Later they and the eastern lands were distinguished as East and West Indies.

EAST INDIES, Dutch, the name collectively given to the islands in the Malay Archipelago, owned by Holland. They include Java, *Sumatra, Madura, Billiton,* Celebes, the Moluccas, Bali, Riau Lingga, parts of Timor, Borneo and Papua, and numerous smaller islands. The total area is estimated at 739,559 square miles, or nearly three times that of Texas or of the province of Alberta. Politically they are divided into two main divisions, known as Java and Madura, and Outpost Provinces. The colony as a whole is administered by a governor-general sent from The Hague, assisted by a council. The capital is Batavia, with a population of 138,551 in 1911. Population of the colony, estimated at 48,000,000 in 1912.

EAST LIVERPOOL, Ohio, the most important porcelain and pottery center in the United States, situated in Columbiana County and on the Ohio River, near the eastern border of the state. Pittsburgh, Pa., is forty-four miles southeast, and Wheeling, W. Va., is fifty miles south. Railway transportation is provided by the Pennsylvania Lines. Freight packet lines connect with all important ports on the Ohio River, and interurban electric lines communicate with cities north, east and south. Chester and Newell, W. Va., across the river, are connected with East Liverpool by bridges. In its population of 22,586 (1916) Americans predominate, but English, Scotch, Irish and Germans form a considerable number; the figure given shows an increase of 2,199 since 1910. The area of the city is about three square miles.

Owing to the extent of its pottery industry, East Liverpool is locally known as the *Staffordshire of America.* There are over thirty pottery works in the city; their products include white granite, terra-cotta, yellow and Rockingham wares. Dinner-ware, floor tile, electrical supplies and toilet wares are manufactured by the porcelain plants. There are also flint mills, glass works, foundries and machine shops. Natural gas furnishes light and fuel. The principal buildings of the city are the Federal building, erected at a cost of nearly $160,000; a $150,000 high school; a $70,000 New Elks' Temple, a $70,000 I. O. O. F. building and the Potters' Savings and Loan Building, which cost $100,000. The library was a $50,000 gift of Andrew Carnegie.

East Liverpool was settled in 1798 and named Saint Clair, in honor of General Arthur Saint Clair of Revolutionary fame. Early in 1802 the name was changed to Fawcettstown, and in 1816 to Liverpool. In 1834 it was incorporated as a village, when it received its present name. The first pottery was built on the banks of the Ohio River, by the Bennett

Brothers; this plant was swept away by the flood of 1852 and was not rebuilt.

EASTON, *ees'tun*, PA., an important shipping point in the eastern part of the state, a manufacturing city, and the county seat of Northampton County. It is situated on the Delaware River, which forms the eastern boundary of the state, at the point where it receives the waters of the Lehigh River. Allentown is seventeen miles southwest, Philadelphia is sixty-nine miles south and New York City is seventy-four miles east. The Central of New Jersey; the Delaware, Lackawanna & Western; the Lehigh Valley, and the Pennsylvania railroads serve the city, and interurban trolley lines connect with adjacent cities and towns, serving 200,000 people. Bridges connect with Phillipsburg, across the Delaware River, and with South Easton, on the opposite shore of the Lehigh. All nationalities are represented in the population, which increased from 28,523 in 1910 to 30,530 in 1916. The area of the city exceeds three square miles.

Easton is located in the picturesque valley of the Delaware and Lehigh rivers, bordered by rugged hills, on the slopes of which the newer section of the city is built. The older part has a central public square, and many of the buildings were constructed before the Revolutionary War. The city has a $75,000 Federal building, a $75,000 Carnegie Library, handsome bank buildings constructed at a total cost of $1,000,000, and three hospitals. Lafayette College, Park Academy and two business colleges supplement the public school system.

The region surrounding Easton is known as the great cement belt, but it is also rich in deposits of slate, iron ore and anthracite coal. Within a twenty-five mile radius, sixty-five per cent of the entire American slate output is quarried and manufactured, and forty per cent of the entire American Portland cement output is made. There is direct water route to New York and Philadelphia. Its many, varied manufactures range from heavy mining machinery to light silken fabrics. There are several large blast furnaces, rolling mills and foundries. About 5,500 people are engaged in the silk industry.

History. Easton was founded in 1752, was incorporated as a borough in 1789 and was chartered as a city in 1887. It was named for William Penn's manor-seat in England. Important treaties with the Indians were made here at various times between 1756 and 1761, and it was the starting point for General John Sullivan's expedition against the Iroquois Indians. The Reformed Church in North Third Street, used as a hospital by the patriots during the War of Independence, and the home of George Taylor, one of the signers of the Declaration of Independence, are historical features of interest. In 1912 Easton adopted the commission form of government, with five elective officers. T.A.H.H.

EAST ORANGE, N. J., a residential city in Essex County, ten miles west of New York City. It is in the northeastern part of the state, adjoining Newark, and with Orange, West Orange and South Orange, forms practically one community known as "the Oranges." It is served by the Orange branch of the Erie Railroad, which has two stations in the city, and by the Delaware, Lackawanna & Western, which has four stations. There are electric lines to neighboring cities. The population, which in 1910 was 34,371, was 42,458 according to a Federal estimate of 1916.

East Orange has many attractive suburban homes and villas. There are several handsome churches, a $400,000 high school building, a city hall, a Carnegie Library and the clubhouse of the Woman's Club of Orange. There are important manufactories of dynamos and other electrical appliances, pharmaceutical supplies, valve fittings and water-works supplies.

The township of East Orange was separated in 1863 from the township of Orange, which in 1806 had been separated from the township of Newark. It became a city in 1899. R.H.D.

EAST PROVIDENCE, R. I., a town in Providence County, on the east bank of the Seekonk River, by which it is separated from Providence, the state capital. It is on the New York, New Haven & Hartford Railroad and on electric interurban lines. The industrial enterprises include oyster fisheries, chemical, electrical and wire works, a shoe-string factory and a bleachery. East Providence was settled about 1644 and was first a part of Rehoboth. Seekonk was separated from Rehoboth in 1812, and after the adjustment of the Massachusetts-Rhode Island boundary line, East Providence was separated from Seekonk and incorporated in 1862. The area of the town exceeds thirteen and one-half square miles. In 1910 the population was 15,808; in 1916 it was 18,113.

EAST RIVER, the ten-mile strait connecting Long Island Sound and New York harbor, separating the boroughs of Brooklyn and Manhattan. It is connected with the Hudson River by the Harlem River and Spuyten Duyvil

Creek. The former rock obstruction at Hell Gate, the waterway between Ward's and Randall's islands, was removed by blasting in 1885, leaving the channel wide enough for the passage of the largest ships into Long Island Sound. Within the space of one square mile, crossing the East River, are the four greatest suspension bridges in existence. The lower part of the East River is a part of New York's great harbor. The United States Navy Yard, one of the leading stations of the country, is located on the Brooklyn side and comprises an area of forty-five acres.

There are no shipping piers for trans-Atlantic lines on East River, as these are located on the other side of the island, in the Hudson River. The West Indies' boats and those in the coastwise trade have nearly all their docks in the East River and on the southern shore of Long Island.

EAST SAINT LOUIS, ILL., an important railway and manufacturing center and one of the largest distributing points for live stock in the United States. It is situated in Saint Clair County, on the southwestern border of the state and on the east bank of the Mississippi River. The Eads Bridge (see EADS), classed with the finest steel arch bridges in the United States, connects it with Saint Louis, Mo., on the opposite bank. East Saint Louis is the terminus of all the railroads entering Saint Louis from the east—the Baltimore & Ohio Southwestern; Chicago, Peoria & Saint Louis; Cleveland, Cincinnati, Chicago & Saint Louis; Illinois Central; Louisville & Nashville; Mobile & Ohio; the Wabash, and the Pennsylvania Lines. The city also has the service of the packet lines on the river and of several interurban lines. In 1916 the population was 74,708, an increase of 16,161 since 1910. The city occupies an area of twelve square miles.

Near the river the land is low, and this part of the city is occupied by the grain elevators and many of the industrial establishments. The residence district lies farther east. In recent years several millions of dollars have been expended on public improvements, principally for drainage and flood protection. There are several parks, a city hall, a high school, a Roman Catholic academy, a public library and a business college. Manufacturing and industrial interests are increased by the location of the city near the vast coal fields of Illinois. The leading products are malleable iron, railway-track accessories, locomotives, foundry *products, railway-car supplies,* baking powder and flour. There are large rolling mi and coke plants, and one of the large yards in the United States; beef a packing is an extensive industry. Th one of the largest and most importa markets in the Union.

East Saint Louis was incorporated lage in 1861 and as a city in 1865. I was swept by a tornado which caused of 500 lives and destruction of prope mated at $10,000,000.

EATON, *e'tun,* SIR JOHN CRAIG (18 a Canadian merchant, since 1907 pres T. Eaton Company, of Toronto and W the great merchandising firm establi his father, the late Timothy Eaton. T which employs about 15,000 men and operates the largest department stor Dominion and is regarded almost as a institution. The founder of the firm his son, who was born in Toronto and the Toronto Model School, to a career. Under the direction of the business continued to grow, but its h found time for much philanthropic w the outbreak of the War of the Na 1914 Eaton at once donated $100,00 Canadian government for the equipm battery, and offered the use of his yacht, said to be the fastest on th Lakes, and his wireless station, the m erful in Canada. The firm of T. Eat pany continued to pay full salaries t its employees who enlisted for active and also insured their lives in or dependent families need not suffer fr erty in the event of the bread-winner In recognition of his patriotic service was knighted in 1915.

EAU CLAIRE, WIS., the commerci of the northwestern part of the stat for its lumber interests. It is the cou of Eau Claire County, and is situate west of the geographical center of t at the head of navigation of the C River, which at this point receives th of the Eau Claire River. These tw divide the city into three parts, w connected by several bridges. By r Paul is eighty-seven miles west, Dulut miles northwest and Madison, the c Wisconsin, 184 miles southeast. The apolis, Saint Paul & Sault Sainte Ma Chicago, Saint Paul, Minneapolis & and the Chicago, Milwaukee & Saint P ways serve the city; electric lines conn

Chippewa Falls, ten miles north. Germans and Norwegians predominate in the mixed population, which in 1916 was 18,807, an increase of 497 since 1910. The area exceeds thirteen square miles.

Locally, Eau Claire is known as *The Heart of the Chippewa Valley*. Commercially it is entitled to the name, as it is the wholesale and jobbing market and lumber center for this prosperous valley. Abundant water power for manufacture is provided by the two rivers named above. Besides extensive lumber mills, there are foundries, paper mills, steel and iron works, canneries, woolen and linen mills and manufactories of shoes, furniture, refrigerators and boxes. Eau Claire is also the hub of the agricultural and dairy section of this part of the state. The city has a Federal building, completed in 1909 at a cost of $175,000, a $100,000 Y. M. C. A. building, a Carnegie Library with 17,200 volumes, and one of the state normal schools, built at a cost of $225,000. There are four parks, a tuberculosis sanitarium and two hospitals.

Eau Claire was settled in 1845 and was incorporated in 1856. The name is a French term meaning *clear water*. The growth of the city began with the development of the northwestern lumber trade in 1870. The city was the first in Wisconsin to adopt the commission form of government (1910). R.F.K.

EBERS, *ay'berz*, GEORG MORITZ (1837-1898), a German writer of historical tales and one of the leading authorities on matters pertaining to ancient Egypt, was born in Berlin. He was early in life a pupil of Froebel, but soon began the study of ancient remains in Egypt. In 1875 he was appointed professor of Egyptology in Leipzig, but on account of ill health resigned in 1889. He visited Egypt many times and made excavations which revealed valuable papyrus manuscripts and specimens of Egyptian art. His works descriptive of Syrian and Egyptian life have the charm of appealing to public curiosity about distant ages and strange lands, and include *Egypt in Picture and Word*, *An Egyptian Princess*, *Uarda* and *The Sisters*.

EBONY, *eb'uni*, a wood famed for its hardness. Its color gives rise to the expression, "black as ebony." The most valuable ebony is the heart-wood of a tree found in India and Ceylon, which yields logs from one to three feet in diameter and from ten to fifteen feet in length. Other choice varieties are found in the East and West Indies and in British and French Guiana. A fair grade is occasionally furnished by certain species of the persimmon tree common throughout the Southern United States. Because it will take a high polish, ebony is in demand for ornamental cabinet work, musical instruments, inlaying and veneering. Because of its durability the black piano keys are made from it.

Reference to its use by the ancients for scepters, images and drinking cups is found in the classics. Herodotus mentions it as an article of tribute, and still earlier Ezekiel (*Ezekiel* XXVII:15), in his lamentation for Tyre, says:

"They brought thee for a present horns of ivory and ebony."

The bark of the tree mixed with pepper is used medicinally by the natives of India.

ECCLESIASTES, *ek kle zi as'teez*, a book of the Old Testament whose authorship is unknown, but which is ascribed to a late Biblical period because of its language and style of composition. The Hebrew name *Koheleth* means *preacher*, and many thought that Solomon was the author, because Koheleth calls himself the son of David, but now the name is considered merely a general term. In this book the preacher questions everything—the value of immortality, virtue, divine justice and the advantage of wisdom, but he wishes to teach contentment and quiet enjoyment of the blessings God has bestowed on man. It is not a historical but rather a poetical composition.

ECHIDNA, *e kid'nah*, or **SPINY ANT-EATER**, a genus of peculiar Australian mammals, closely related to the duckbill (which see), both of which in some ways resemble mammals, birds and reptiles. The echidna has a twelve- or eighteen-inch body, covered above with hair and hedgehoglike spines, and below with soft hair. It has short, strong legs, ending in five toes armed with powerful claws, which enable it to dig into the ground to make its burrow. The head is small and extends into a long, slender snout, from which a long, flexible, sticky tongue can be thrust to gather its food of ants and other insects. There are no teeth, but the palate is furnished with spines. The female echidna lays one or two eggs, one then being placed in a temporary pouch in her body and carried there for two weeks, when it hatches. The young echidna is also carried in that pouch until it is ready to walk. The value of this strange animal is doubtful.

ECHINODERMS, *e ki'no durmz*, one of the great branches of the animal kingdom, the name of which, meaning spiny-skinned, refers

to the prickly covering characteristic of many members of the group. According to the modern classification, the echinoderms are ranked between the insects (Arthropoda) and the vertebrates. All make their home in the sea. They are divided into starfishes, sea urchins, brittle stars, sea cucumbers and sea lilies. Their typical structure is that of a central disk, from which five arms radiate, much as the spokes of a wheel branch from the hub. In some species the arms divide again and again. The mouth is located on the underside of the central disk.

Embedded in the body wall of nearly all echinoderms is a skeleton made up of minute plates consisting of lime and carbonic acid. These plates often bear spines, which are admirable weapons of defense and also serve to protect the internal organs. The organs of digestion and reproduction are contained in a body cavity enclosed by the body wall. Seaweed, clams, oysters, barnacles and other marine animals are consumed by some species, and the sea cucumbers take into the body large quantities of sand. There are about 3,000 living species, found in all the seas of the globe, but they are most abundant in tropical waters.

Related Subjects. The reader is referred to the following articles in these volumes:

Arthropoda	Sea Urchin
Crinoidea	Starfish
Sea Cucumbers	Vertebrates

ECHO, *ek'oh,* a reproduction of sound caused by sound waves striking an obstacle and being thrown back towards their starting point. How sound originates is explained under the title SOUND, in these volumes. Whether or not the word *echo* was applied because of the old Greek myth described below, people will nevertheless always associate it with that pleasing, sentimental tale.

An echo may be reflected from a building, a hill or other obstacle, either directly back towards the point at which it originated, or at such an angle that the sound cannot be heard at the point of origin. Sound travels at the rate of 1,080 feet per second when the temperature is at the freezing point. The echo travels at the same speed as the original sound, so that anyone standing 540 feet from the reflecting obstacle would hear the echo in one second, if it were sent straight back to him. The velocity of sound increases at the rate of *two feet* per second for every rise of one degree *in temperature; in* the average temperatures of North America it travels about 1,125 feet per second.

At Woodstock, England, there is a remarkable echo which repeats fourteen syllables, but in most cases the echo can only make audible such sounds as can be heard in one second. A single sound such as a shout may be thrown back distinctly by many cliffs, but a sentence is usually a confusion of sounds, and only the last syllable is audible. An echo is often helpful to mariners in foggy weather by enabling them to calculate the distance to cliffs from which the sound is reflected. The time between production of the sound and hearing of the echo is noted, and the distance is easily ascertained.

In Greek Mythology. Echo was a beautiful nymph, an attendant of Diana, the huntress, and noted for her conversational powers. On one occasion when the jealous Juno was seeking her husband Jupiter, believing him to be with the nymphs, Echo detained her in conversation until Jupiter escaped. The goddess punished her by condemning her never to speak first, and always to repeat the last word she heard from others. A more poetic version is that Echo fell in love with Narcissus, a beautiful youth insensible to love, and because he did not return her affection she pined away until nothing was left but her voice, which may still be heard in the mountains, speaking only when spoken to and replying only in the exact words of the speaker. Many poets have found inspiration in this legend, among them Shelley in his poem *Adonais*:

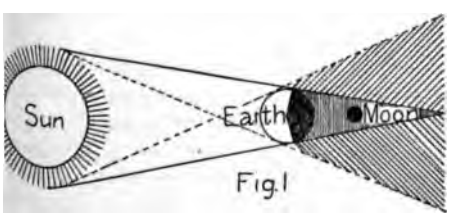
Lost Echo sits amid the voiceless mountains,
And feeds her grief.

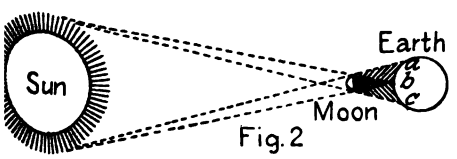
ECK, JOHANN MAIER VON (1486-1543), a German debater and writer, and powerful opponent of Martin Luther, was born in Suabia. He entered the University of Heidelberg at the age of eleven and obtained a degree at Tübingen when he was fourteen. In 1510 he became professor of theology at Ingolstadt, and in 1518 wrote and privately circulated a pamphlet against Luther's thesis on the mass. Carlstadt, who was a most extreme reformer, and Luther wrote replies to this work, and Eck finally challenged Luther to debate with him at Leipzig on the Papal supremacy. This meeting took place in June, 1519, and after a discussion of three weeks, he forced Luther into an admission that, under certain circumstances, it might be right to disobey the Pope and the great Council of Constance. Eck left Leipzig the victor in the encounter but still w

satisfied, and in 1520 he visited Rome and ed the Pope to take measures against her. The Pope assented and he returned h the bull, or edict, of condemnation, which her publicly burned. In 1527 Eck disputed Baden, Switzerland, with Haller of Berne attended the Augsburg Diet in 1530. He took part in the conference at Worms in). See LUTHER, MARTIN. G.W.M.

CLIPSE, *e klips'*, the total or partial ob- ing of a heavenly body by another or by shadow of another. This phenomenon is ed an *eclipse* only when it affects the sun he moon. The hiding of one star by an- er is called an *occultation*. A very simple eriment clearly illustrates the phenomenon an eclipse. A small marble held between thumb and forefinger a short distance be- e one eye will completely hide the moon; a greater distance it shows the effect of an *ular* eclipse, by which is meant leaving a g of the moon visible. By moving it to e side the appearance of a *partial* eclipse y be obtained. The same results would be ticed with regard to the sun, but that body too bright to be directly regarded by the ked eye.

Superstitions concerning the supernatural ses of eclipses have not yet completely died t. In Russia an eclipse is still believed by e peasants to be a sign of the wrath of God. 1914, during the early stages of the War of





DIAGRAMS EXPLAINING ECLIPSES

e Nations, an eclipse occurred, and a special rning was issued explaining to the ignorant ssian soldiers that it was not a sign that od had doomed them to defeat.

Eclipse of the Moon. Although long re- rded as supernatural, an eclipse of the moon easily explained as the result of purely natural causes. The light of the sun upon the earth causes the earth to throw a shadow into space. When the moon, in its journey round the earth, enters that shadow it becomes obscured. It may be totally or partially eclipsed, but even when completely in the shadow of the earth it remains visible, owing to the refraction of the sun's light. The eclipse always commences on the eastern side of the moon and ends on the western. A total eclipse may last two hours, as the shadow thrown by the earth at the point where the moon enters it is double the diameter of the moon, which itself travels the length of its diameter in one hour. Lunar eclipses happen only when the moon is at the full. They do not happen at every full moon, as the moon generally passes the shadow without entering it. The accompanying diagram shows the conelike nature of the shadow thrown by the spherical body of the earth (see Fig. 1). It completely eclipses the moon to those on the side of the earth directly opposite the sun.

Eclipse of the Sun. When the moon passes between the earth and the sun it hides the face of the sun, partially or completely. It may pass so near to the earth that the face of the sun is fully covered, or it may pass across the sun so that only part of that orb is concealed. What is termed an *annular* eclipse may be produced by the passage of the moon at such a distance from the earth that it obscures only the central portion of the sun's disk, leaving an outer ring visible. An eclipse of the sun commences on the eastern and terminates on the western side. The accompanying diagram (Fig. 2) explains the cause of a solar eclipse. The moon, being between the sun and the earth, throws its direct shadow on the earth at *b*, and to anyone on the earth at this point the eclipse would be total. The outer shadow between the true shadow and the full outside light falls on the earth between *b* and *a* and *b* and *c*. To persons on the earth between these points the sun would be partially eclipsed.

Predicting Eclipses. To the general observer it appears little short of miraculous that eclipses can be accurately predicted, but to the astronomer, with the resources of spherical trigonometry at his command, it is a comparatively simple matter. It does seem almost incredible, however, that the ancients, who possessed almost no accurate scientific knowledge as to the movements of the heavenly bodies, should have been able to foretell

pendent on the help of the races on the other side of the globe than our grandfather's grandfather was on that of his next-door neighbor; the interruption of trade by the War of the Nations caused economic distress even in far-away Brazil.

If there were no artificial restrictions the world would soon reach the stage where every person in it would coöperate to some extent with every other person. Just as it would be foolish for each of the two on the island to gather his own berries and his own eggs, so to economists it seems useless for a nation to attempt absolute independence of other nations. If France can make silk better and more cheaply than it can be made in Canada, and Canada can raise wheat more easily than can France, both countries will have more wealth if they accept each other's help.

Distribution of Wealth. The complex division of labor in the modern world increases the difficulty of knowing what is the just reward of each factor. If you borrow a saw from your neighbor to build a bench, it is plain that the added value given the lumber in its new form is partly due to your labor and partly to the saw, for each is indispensable. As the owner of the saw either made the tool himself or bought it with other products of his labor, other labor than your own enters directly into the building of the bench. In economics the saw is called *capital*, as it is a product of past labor used for further production, and the reward to which the owner of it is entitled is *interest*. Ordinarily we think of capital as money, but if your neighbor lends you money to buy a saw he is in effect lending you a saw; the reward is interest, whether the saw or the money is loaned, the word *rent* being restricted in economics to land. The conflict which goes on the world over between capital and labor is only an enlargement of the difficulty which you and your neighbor will have in determining a just interest for the saw.

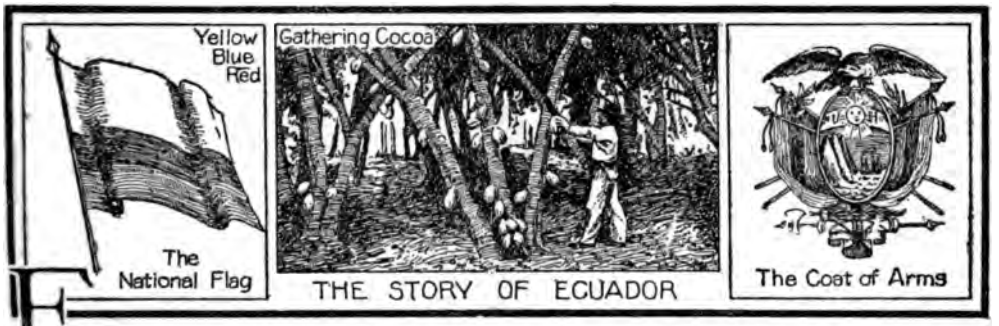
Over the third factor, land, there is less dispute, principally, no doubt, because land owners and capitalists in many countries are as a rule the same people. Nevertheless, by some economists most of the poverty in the world is ascribed to the institution of private ownership of land, which is not, like capital, the product of past labor.

Supply and Demand. In general, as economics shows, value is regulated by supply and demand. Thus diamonds, though not so useful as potatoes, are more valuable because the demand for them always exceeds the supply, while there are usually enough potatoes for all. Demand and supply act and react throughout all industry. Suppose the supply of laborers in a country becomes scarce; wages then rise. In one business, let us say clock-making, most of the manufacturers find that if they pay an increased wage in order to secure men they will lose money. Therefore they leave the clock-making business, and as a result there are fewer clocks made. At first this gives greater profits to clock-makers who have remained in the business, for they are able to charge higher prices. But the increased profit attracts other men to making clocks, and soon the supply is greater than ever. This may result in two things: (1) a greater cost of making clocks, due to the increased demand for labor and materials; (2) a lower selling price for clocks. This again reduces the profits and drives out the weakest clock-makers. But it does not bring us back to our starting point, for the low price of clocks means that people who never owned them before can now buy them, and this increased demand is sufficient to keep some of the new manufacturers in the business and eventually to lead others into adopting it.

Money. You and your companion on the island would find little difficulty in dividing your berries and eggs. But if the castaways numbered fifty you would no doubt find it necessary to adopt some system of shell money. Money, as economics teaches, exists as a help in exchanging the products which we make for one another, but too often we think of it as a thing to be desired for itself. On the contrary, the presence of too much money in a country may be harmful. After the Franco-German War of 1870, France was obliged to pay to Germany an indemnity of about $1,000,000,000 within three years. When, as a result, the supply of money became less in France, its value became greater, and a franc went farther in wages than before. In Germany, of course, the reverse was true. Thus, because of the high wages they had to pay, German manufacturers were not able to sell their goods to the world as cheaply as the French could sell them, and the world witnessed what Bismarck called an absurd miracle—France prosperous and Germany in difficulties because of their respective loss and gain of money. (The subject of money is fully treated under its own title.) G.H.E.

Related Subjects. For the guidance of those who wish to review or study the entire range of economics there are presented below, in alphabetical order, all the topics relating to the subject which are discussed in these volumes:

Annuity	Corporation	Gresham's Law	Rebate
Bimetallism	Credit	Income Tax	Reciprocity
Blacklist	Customs Duties	Inheritance and Inheritance Tax	Rent
Bounty	Debt	Interest	Single Tax
Boycott	Eight-Hour Day	Labor, Division of	Socialism
Budget	Embargo	Labor Organizations	Statistics
Capital	Emigration	Minimum Wage	Strike
Collective Bargaining	Employers' Liability	Money	Supply and Demand
Communism	Factory and Factory System	Mothers' Pensions	Sweatshop System
Conservation	Famine	National Debt	Syndicalism
Consumption	Free Trade	Old Age Pensions	Tariff
Coöperation	George, Henry	Open Shop	Tax
Corn Laws		Pauperism	Tenement
		Pension	Trusts
		Peonage	Usury
		Population	Value
		Profit	Wages
		Protection	Wealth



ECUADOR, *ek'wa dawr,* a centralized republic in the northwestern part of South America. In shape it is a triangle, with its base on the Pacific Ocean. Its name, which was once Quito, is now the Spanish form of the word *equator.* The area of Ecuador has been estimated at about 116,000 square miles of mainland and 2,400 of islands, a total of 118,400 square miles. It is therefore about twice as large as Georgia or a little less than half the size of the province of Saskatchewan.

Ecuador is unusual among tropical countries for the reason that, while it lies directly across the equator, it is habitable by white people because of its elevation. Other lands crossed by that line are generally unsuited to be the homes of the white man; but the table-lands of Ecuador enjoy the delight of never-ending spring.

The islands (Galapagos) possess a peculiar interest for the scientific world, because of the voyage of the *Beagle* (1831-1836), which enabled Charles Darwin to "reveal a new world" by his study of the native animal and vegetable life, the species of which had become multiplied through the separation of the islands since their formation. This voyage has been compared to that of Columbus, since it led to the discovery of the origin of species and revolutionized the science of the world.

The People and Their Cities. Of the population of Ecuador, estimated at 1,500,000, the white people and the *metizos* (persons of mixed blood) constitute scarcely more than a quarter, fewer than 500,000. When we speak of the great majority in that country as "Indians," we must divest ourselves of the idea of wandering tribes of barbarians. At the time of the Spanish conquest four centuries ago, the country was highly civilized on the Inca plan, though it had little in common with European civilization. See INCA.

LOCATION MAP

Showing the position of the republic, and the proportion of the continent occupied by it.

The aboriginal people of Ecuador were industrious and orderly, and their descendants to-

day possess these virtues in a high degree. They believe in education and have not only provided it, but have made it compulsory. Their police service is one of the most efficient in South America. Appreciation of literature and art is shown in their national library, astronomical observatory, conservatory of music, school of fine arts and school of arts and crafts, as well as in their public statuary and in much of their architecture. Ecuadorians have upheld the gold standard of money; have caused their condor (gold piece) to conform in value to the British pound sterling ($4.86) and have been solicitous to maintain public credit. In art they are famous for their sculpture and painting.

Quito, the capital, and Guayaquil, the chief port, are nearly equal in size, Quito being somewhat the larger and containing about 80,000 inhabitants. Cuenca, in Southern Ecuador, has about half the population of Quito. To reach Quito railway coaches have to ascend a distance of nearly two miles; the traveler has in this an experience unparalleled elsewhere in the world.

Communications. Nearly all travel in Ecuador starts from the harbor of Guayaquil, to which British, German, Chilean and North American vessels make regular visits. The voyage from Panama to this port is made in three or four days, and can be considerably shortened by fast steamers. Before the opening of the Panama Canal few vessels from the Atlantic ever braved the 10,000 mile voyage around the "Horn" to Ecuador. In 1916 there were fewer than 400 miles of railway in the republic. The railway to Quito, the capital, was completed in 1908; another, to connect the Bay of Caraquez with the capital, was under construction in 1916 by a French company. Other lines are under construction or are planned. Where there are no railways, travel and transportation are slow and difficult by reason of the nature of the country.

COMPARATIVE AREAS

In addition to comparisons made in the text, note that Ecuador (without its islands) is nearly as large as Ohio, Indiana and Kentucky.

Physical Features and Climate. The lowlands of the coast region are oppressively hot, *but are well* suited to the cultivation of cacao, cotton, sugar-cane, coffee, tobacco and tropical fruits.

There are three successive ranges of mountains, rising from the lowlands of the coast and increasing in height to the eastward. The middle range expands into a high plateau, varied by occasional high peaks. This plateau is suited to the cereals and vegetables of the temperate zones. The mountain regions are rich in a variety of ores, including gold, mercury, copper, iron, lead, platinum and silver, though some of these have not been worked. Coal and oil exist in paying quantities, and await development. Large deposits of sulphur are found in the volcanic regions and on the islands.

The *montaña,* or wooded tract, occupies the eastern slope of the Andes. The extensive forests of this region contain many trees of special and peculiar value, such as the *hevea,* which produces the best rubber; the *phytelephas,* which supplies the nuts of vegetable ivory; the *cinchona,* whose bark yields quinine; the silk-cotton tree, from which the French have recently perfected their manufacture of a delicate silk; and the *carludovia,* which supplies the fiber for Panama hats.

Of the mountains, Chimborazo is the highest, rising to the height of 20,608 feet above the sea level. Cotopaxi is one of the most remarkable volcanoes in the world, scarcely approached in terrible sublimity, its thunders being heard at times for hundreds of miles.

Of the limited native animal life of Ecuador, North Americans are generally familiar with the name of—

> "That proud bird,
> The condor of the Andes, that can pierce
> The illimitable expanse of heaven's blue,
> And bathe its plumage in the thunder's home,"

of which George D. Prentice wrote in *The Closing Year.*

The Galapagos Islands have but little value, and contain only 500 people. They are famous for their enormous tortoises, on which grown men can ride.

Religion. Ecuador is intensely Roman Catholic. The liberal element is within the Church, not without; and the strongest opposition to clerical influence comes from Catholics themselves.

Commerce. Whether in the matter of imports or of exports, the United States is the second among countries trading with Ecuador; Great Britain supplies the most imports, and France takes away the most exports. Before

the War of the Nations Germany stood third in regard to both. Ecuador supplies one-third of the world's cacao (chocolate). Vegetable ivory, supplying an excellent substitute for the ivory of elephants' tusks, is used chiefly for making buttons, and has been largely taken by Germany. Panama hats are manufactured chiefly in the province of Manabi. More than a million pounds of rubber is produced annually. Excellent coffee is raised, and of this the surplus above home consumption is taken chiefly by Chile.

Commercial Possibilities. Ecuador is a land of opportunity. Much attention has been called to the opening for cattle raising. Mining has been but little developed, as yet. The Panama Canal and the railway to Quito having rendered the capital easily accessible, the region of eternal spring offers superior attractions to tourists, and the South American call for "American" hotels applies here as elsewhere. Shoes are made by hand in Quito, and much of the manufacturing is done on a small scale. With railways to build, mines to develop and forest products to be gathered, there is excellent opportunity for the investment of capital.

History. The kingdom of the Quitus, on the equator, was perhaps 1,200 years old at the time of the Peruvian conquest in 1460. In 1533 there was a change of masters, for the Spanish seized the country. Independence was secured by the Battle of Mount Pichincha (nearly two miles above the sea level), in 1822, by the patriot leaders, Sucre and Santa Cruz. At first united with New Granada and Venezuela, Ecuador became a separate republic in 1830.

This little republic has been one of the most turbulent states in the world. As a rule its only peaceful days have come when some one man has been strong enough to make himself dictator. The struggle of the patriots against the corrupt rule of the clerical interests has lasted from the foundation of the republic to the present century. President Gabriel Moreno, a despot who bowed only to the clergy, was assassinated in 1875. The constant revolutionary intrigues of the Church party provoked President Plaza in 1904 to declare all churches on an equal footing and finally to confiscate Church property. In 1905 the clericals elected their candidate, but he was driven from office by Ex-President Alfaro. In 1912 Plaza seized the Presidency, and after defeating the opposition, handed over the gov-

Outline and Questions on Ecuador

I. Position and Size

(1) Latitude
(2) Longitude
(3) Actual area, 116,000 square miles
(4) Comparative area

II. Physical Features

(1) Coastal lowlands
(2) Mountain section and plateaus
  (a) Great peaks
(3) The *montaña*
(4) Climate
  (a) Dependence on altitude

III. The People

(1) Predominance of Indians
(2) Other races
(3) Attitude toward education
(4) Religion
(5) Cities

IV. Industrial Development

(1) Agriculture—main industry
(2) Unworked mineral resources
(3) Limited manufactures
(4) Communication and commerce
(5) Opportunities for development

V. History and Government

(1) Antiquity
(2) Spanish conquest
(3) Republic established
(4) Recent development

Questions

What does the name *Ecuador* mean?

Why would you rather live in Ecuador than in most tropical countries?

What did certain possessions of this country have to do with one of the most noteworthy voyages in the world's history?

Who are the *mestisos?* What race makes up the greater part of the population of the country?

What indicates the attitude of the government toward education?

About how long does it take to go from Panama to the chief port of Ecuador?

How long a stretch of railway is there to each hundred square miles of area?

Look on the map of South America for Quito. Considering its latitude, how can it be called the "City of Eternal Spring"?

What part of the dress or suit you have on may well have come from Ecuador?

Is the highest mountain in the country as high as the loftiest peak of the United States? Of Canada?

What characteristic form of animal life has given its name to the monetary unit of the country?

Of what important commodity does Ecuador produce more than any other country in the world except one?

ernment to his elected successor, Alfredo Moreno, in 1916.

Other Items of Interest. Though Ecuador as a republic is over eighty years old, it has never had a general census.

The interest of the national government in education may be seen from the fact that about twelve per cent of the annual budget is devoted to educational purposes.

Among the countries of the world, only the Gold Coast, in Africa, produces more cocoa.

The Andes region is far from stable; it has been estimated that Quito and the surrounding territory sank twenty-six feet during the nineteenth century.

Quito, the capital, is known as "the City of Eternal Spring," and it deserves the name.

Chimborazo has no fewer than eleven true glaciers, some of them very large.

One of the most interesting of the mountains of Ecuador is the volcano Pichincha, which is situated not far from Quito. Some of its eruptions have been most destructive to the capital city, but the last one broke down the western wall of the crater, and it is believed that this will save Quito in case of further eruption.

The present constitution of Ecuador dates from 1906. It places the executive power in the hands of a President who is elected for a term of four years by the direct vote of the people. He may not succeed himself. H.M.S.

Consult monthly bulletins of the Pan-American Union, Washington, D. C., obtainable on application; Enoch's *Ecuador*.

Related Subjects. The following articles in these volumes will be helpful to the reader who is interested in Ecuador:

Andes	Galapagos
Chimborazo	Guayaquil
Chocolate	Ivory Palm
Cocoa	Quito
Coffee	Rubber and Rubber Manufacture
Cotopaxi	

ECZEMA, *ek'ze ma,* one of the commonest skin diseases, which includes from one-third to one-half of all cutaneous affections. It is characterized by intense itching and an oozing of serum which forms crusts and scales. It may be acute or chronic in its course. The external causes of eczema are acids and poisons and animal and vegetable parasites. The internal causes are mainly scrofula, gout, wrong diet and the use of alcoholic beverages. Eczema is sometimes called *salt rheum,* from an old belief that it is a humor of the blood. Treatment of eczema should be both external and internal, but only under care of a physician. Treatment without the watchfulness of the doctor may multiply its dangers. W.A.E.

EDDA, *ed'ah,* a title applied to two ancient works in Scandinavian literature, known as the Elder, or Poetical, Edda, and the Younger, or Prose, Edda. The first of these, ascribed to Saemund the Wise, was compiled some time between the tenth and the thirteenth centuries, and consists of thirty-three songs, which treat of the Scandinavian gods and heroes. The Prose Edda is ascribed to the Norse historian and politician, Snorri Sturluson, who flourished in the first half of the thirteenth century. It treats of the mythology of the North and of the versification and modes of composition of the *skalds,* or ancient poets. It was intended to serve as a guide to young poets, and was first published in the seventeenth century.

EDDY, *ed'i,* CLARENCE (1851-), an American concert organist of the present time. His repertoire comprises practically everything that has been written for the organ, to which he gives a masterly interpretation, as well as hundreds of manuscripts which have been dedicated to him. His organ collections are used extensively throughout the world, and his compositions are also renowned. He is a native of Greenfield, Mass., and was educated in America and in Germany. After a successful concert tour in Germany, Austria, Switzerland and Holland, he returned to America and located in Chicago, becoming organist successively in several of the foremost churches. Mr. Eddy's ability both as artist and composer has been recognized by European critics.

EDDY, *ed'i,* MARY BAKER (1821-1910), the discoverer of Christian Science and the founder of the Christian Science Church. She was born at Bow, near Concord, N. H., and was educated in the public schools, at Sanbornton (N. H.) Academy and by private teachers. She was of a religious nature, and at an early age was admitted to membership in the Congregational Church, in spite of her inability to subscribe to some of its doctrines. This membership was retained until she founded her own Church.

In 1843 she married George W. Glover, who took her to Charleston, S. C. He died about a year later, and she returned to the home of her parents practically without means; as a matter of conviction she had liberated the slaves her husband had held. Here a son, George W. Glover, was born. As she was in

very delicate health and dependent upon her family, her position was a difficult one. She was always a devout student of the Bible, and in her distress of body and mind she constantly turned to it for relief and guidance, and in 1866, while suffering from a serious accident, she gained the perception of the meaning of the Scriptures which brought about her own healing and gave rise to the religion she founded. Of this experience she afterwards published the following account, which is found in her work, *Miscellaneous Writings:*

> Saint Paul writes: "For to be carnally minded is death; but to be spiritually minded is life and peace." This knowledge came to me in an hour of great need; and I give it to you as death-bed testimony to the day-star that dawned on the night of material sense. This knowledge is practical, for it wrought my immediate recovery from an injury caused by an accident, and pronounced fatal by the physicians. On the third day thereafter, I called for my Bible, and opened it at Matthew IX. 2. As I read, the healing Truth dawned upon my sense; and the result was that I rose, dressed myself, and ever after was in better health than I had before enjoyed. That short experience included a glimpse of the great fact that I have since tried to make plain to others, namely, Life in and of Spirit; this life being the sole reality of existence.

After nearly a decade of work in pondering her discovery, perfecting its statement and proving its worth to her fullest satisfaction, she produced in 1875 her fundamental contribution to the religious and therapeutic thought of the world in *Science and Health, with Key to the Scriptures,* which is the "text-book" of Christian Science. It has gone through numerous editions and has come to be one of the most widely read of books. But one translation, that into German, has been authorized. Among Mrs. Eddy's most important other works are *Unity of Good and Other Writings, Christian Healing and Other Writings,* and the *Church Manual.*

In 1877 she married Dr. Asa G. Eddy, who was associated with her in the Christian Science movement, to which she devoted her life from the time of her healing. In 1879 she organized the Church of Christ, Scientist, which in 1892 was reorganized as The First Church of Christ, Scientist, in Boston, Mass. Of The First Church, known also as The Mother Church, she was pastor for many years.

In 1881 she opened in Boston the Massachusetts Metaphysical College, the only institution of its kind having a charter from the Commonwealth. She founded the periodicals of the denomination, now issued by the Christian Science Publishing Society of Boston, including *The Christian Science Journal,* a monthly; *The Christian Science Sentinel,* a weekly; *Der Herold der Christian Science,* a German monthly; and *The Christian Science Monitor,* a daily newspaper. For a number of years Mrs. Eddy lived in comparative retirement at Concord, N. H. In 1908 she went to Chestnut Hill, a suburb of Boston, where, revered and loved by her many thousands of followers, she remained actively in charge of her large and growing movement until her death, December 3, 1910. See CHRISTIAN SCIENCE. A.C.

Consult Wilbur's *Life of Mary Baker Eddy.*

EDELWEISS, *a'del vise,* a pure silver-white, star-shaped perennial flower. It is Switzerland's national emblem, and plays an important part in that country's legend and poetry. Due to its rarity, laws protect it there. Appearing in exposed places, high in the Alps of Switzerland, Tyrol, Carinthia, Austria and Serbia, its fame is due chiefly to the difficulty in obtaining it. Thrilling tales are told of the lure of the rare edelweiss. That it can be easily cultivated, however, has been proved by its frequent appearance in American and European gardens. The plant grows about six inches high. Its compound flowers are surrounded by small, woolly flower-leaves (bracts) and sage-green foliage leaves. Almost any soil, not too rich and fully exposed to the sun, will produce edelweiss plants, for the woolly covering enables them to hold moisture and endure exposure.

THE EDELWEISS

The word is from the German, and means *noble white.*

EDEN, *e'd'n,* GARDEN OF. In the Bible is told the story of the creation by God of a beautiful garden to be the home of the first human beings. Adam and Eve were put into it and were told that it would be their home as long as they did not disobey God by eating of the "tree of knowledge of good and evil." One day the Maker found that they had done what he had told them not to do, so he put them out of the Garden. The story is told in the book of *Genesis.* Many scientists have tried to locate the place, but probably the Flood materially changed the surface of the earth so it is only guess-work to assume that it was in the valley of the Euphrates River of to-day, as many people assert.

The Garden of Eden meant a place where everything was joy and happiness, and as such is used figuratively in literature to-day. Shakespeare in *Richard II* refers to England as—

> This earth of majesty, this seat of Mars,
> This other Eden, demi-paradise.

EDENTATA, *e den ta' tah,* a small group of animals which do not have teeth in the front of their mouth and therefore live on insects and animal substances in a decaying state. The ant-eaters and pangolins have no teeth at all, while the rest in this group, such as the sloth, armadillo and aard-vark, have simple, rootless teeth near the back of their jaws. The majority of these animals live in South America, although some species are found in Africa and Southern Asia. They are slow in their movements, because of the peculiar structure of their limbs; they have large claws, almost like hoofs, and are covered with coarse hairs, which in the case of the pangolin are united into overlapping scales. The edentata are generally ranked as the lowest of mammals, not merely because of the lack of teeth but because the brain is very small and poorly developed. (Each animal named above is described in its place in these volumes.)

ED'IBLE BIRDS' NESTS, the nests of certain species of swifts, found principally in the Malay Archipelago and regarded as a luxury by the Chinese. The nest has the shape of a common swallow's nest, is found in caves, particularly on the seashore, and has the appearance of fibrous, imperfectly-made isinglass. When procured before the eggs are laid, the nests are of a waxy whiteness and are then esteemed most valuable. The best specimens sell in the Chinese markets for about $12 per pound. They appear to be composed of a *mucil*aginous substance secreted by special glands, and not, as has been previously held, of glutinous seaweed.

EDICT OF NANTES, *nahNt.* See NANTES, EDICT OF.

EDINBURGH, *ed' in bur o,* Scotland's capital and second city, and the center of its intellectual and religious life, is a city rich in memories. Within its boundaries were staged many scenes in the life of Mary Queen of Scots and in the contemporary struggles and success of the great presbyter, John Knox; in one of its churchyards was signed the National Covenant, which established the independence of the Presbyterian Church in Scotland, and in one of its cellars, the Act of Union with England, which ended the independence of the Scottish nation. In later days it was a literary center, the home of the *Edinburgh Review,* one of whose founders was Sydney Smith and among whose contributors were Carlyle, Hazlitt, Macaulay and Scott; of *Blackwood's Edinburgh Monthly,* which published contributions from "Christopher North," De Quincey and Scott, and George Eliot's first stories, *Scenes of Clerical Life;* and of *Chambers's Edinburgh Journal,* whose editors were the publishers of the famous *Chambers' Encyclopaedia* and the *Book of Days.* In Edinburgh, Scott spent his early life, Burns enjoyed his first success, Thomas Carlyle began his career, De Quincey passed twelve of his most active years, and Robert Louis Stevenson grew to manhood. Many scenes in and about the city are familiar to readers of Scott's *Waverley Novels* and Stevenson's *David Balfour.*

Edinburgh to-day is a progressive community of 320,000 people. The city owns its water supply, its gas, its street lighting system and its street cars. The municipal government elects a majority of the curators of Edinburgh University, which, though the youngest of Scotch universities, was chartered in 1582, fifty-four years before Harvard College, the oldest in America. Edinburgh has established public markets and public slaughter-houses, and has built houses which are leased to working people. It is proud of its educational institutions, one of which, the Royal High School, was founded in the sixteenth century.

Edinburgh is built on the hills which rise south of the Firth of Forth, from which its business center is about two miles distant. Until the end of the nineteenth century the boundaries of the burgh did not extend to the shore, and its shipping still passes through the port of Leith. The city is divided into the

Old Town and the New Town by a deep ravine, through which runs Princes Street, said to be one of the most beautiful in the world. In the Old Town only one street is wide enough to admit carriages or automobiles.

Among the interesting sights of the city is Holyrood Castle, parts of which were built eight centuries ago; it was the home of the Stuarts before they became kings of England, and is still occasionally occupied by royalty. A monument unusual for Europe commemorates the Scots who fell in America in the War of Secession. There are two libraries, one given by Andrew Carnegie, the other the Advocates' Library, founded in 1682, of which Hume was for some years librarian.

The site of Edinburgh was settled before Roman times, but it did not bear its present name until the seventh century, when it was seized by the Saxons of Northumbria, for whose king it was called Edwin's burgh. The city's nickname, *Auld Reekie,* means *Old Smoky,* though Edinburgh is not a great manufacturing center.

The University. No one of the other three Scotch universities has been the school of as many famous men as Edinburgh. Barrie, Carlyle, Darwin, Conan Doyle, Hume, Scott, Stevenson, Thomson the poet,—all received at least part of their education in it. The university was originally called the Town's College, for it was established by the Edinburgh Town Council and remained under the latter's direction from its opening in 1583 until 1858. It is now governed by the principal and professors, under the supervision of officers of both town and gown. Degrees are given in arts, science, medicine, law, music and theology. Like other Scottish universities, Edinburgh admits women to all its privileges. It shares in the Carnegie funds, and joins Saint Andrew's University in sending a member to Parliament.

EDISON, *ed'i sun,* THOMAS ALVA (1847-), familiarly known as the "Wizard," is the greatest among the world's inventors, one of the very few men of all time who have devoted their lives to invention as a profession. The work of no other man in the field of electrical science approaches the extent and range of his activities, which have been solely in the direction of devices which have stimulated industry and forced advancement more rapidly in a decade than any other influence in like time in the history of the world.

His birthplace was Milan, O., but the greater part of his boyhood was spent in Port Huron, Mich. He began his career as a newsboy on the Grand Trunk Railway, and his taste for experimenting led him to fit up a small laboratory in a compartment of a baggage car. His experiments were brought to an end by the overturning of a bottle of phosphorus which set the car on fire. He next studied telegraphy, and secured a position as telegraph operator at Port Huron, and later in Canada, on the Grand Trunk Railway. After working a number of years in this capacity he began his career as an inventor in 1869; the stock ticker, the first product of his genius which was of commercial importance, was brought out in that year.

THOMAS A. EDISON
He has been called the most useful citizen of the world.

The World's Debt to Edison. The work of Edison includes so many great inventions and has built up so many industries that it is impossible to point out any one of his triumphs as his greatest. One of his first inventions was a machine for recording votes at elections, but after he had perfected it nobody wanted to use it. He then made up his mind that he would never again spend his time on a device or machine which was not of immediate, practical use. Strict adherence to this rule is the reason why Edison's name is familiar the world over. He has not made great discoveries in theoretical science, but he has applied and developed to new uses the principles which other men have established. A partial list of the industries that have been built up wholly or in part on the inventions of Edison is here given to indicate the scope of his work: Electric lighting, brought to its high efficiency through his genius; manufacture of incandescent lamps; manufacture of electric fixtures; the development of electric railways; manufacture of dynamos and electric motors; the telegraph, the efficiency of which he has wonderfully increased; moving pictures; manufacture of the phonograph and the various forms of talking machine that have sprung from the phonograph.

Edison's inventions are the result of almost ceaseless industry and an active imagination.

To a flatterer who once tried to compliment him on his achievements, Edison replied that "Genius is about two per cent inspiration and ninety-eight per cent perspiration." When he works, which is nearly all the time, he becomes unconscious of time and place. His absorption is at times so intense that it is necessary for someone to remind him that he must eat or sleep. He has said that up to 1902 he worked an average of nineteen and one-half hours daily; since that time his working day has averaged eighteen hours. His habit is not so much to do without sleep as to "sleep when he wants to," as he puts it. He has worked practically without sleep for sixty hours, after which he has taken sleep lasting eighteen hours or more and awakened fully refreshed.

When a task is completed and he seeks a vacation he plays as hard as he has worked and drives care entirely from his mind. When he has conceived a new idea he reads everything obtainable relating to the subject; then, with the aid of his assistants, he makes a series of tests, sometimes hundreds, sometimes thousands, of them, no test being omitted that will aid in finding the best device for the purpose. One of the best examples of Edison's method in invention is the incandescent lamp; this is explained in the article ELECTRIC LIGHT.

Edison's part in the development of the electric railway consists principally of his invention of a dynamo that is self-regulating, giving out more current to the line when more current is needed without change of voltage —the compound wound dynamo. Such a dynamo will furnish current for one car or for a number of cars and adjust itself automatically to the load that it is called on to carry.

The moving-picture camera and the machine for showing moving pictures on the screen are both inventions of Edison. The difficulty which he overcame in perfecting the moving-picture camera was that of making twenty pictures a second in one camera. By means of the phonograph and the moving-picture machine he has provided entertainment for millions of people and opened up vast possibilities in the field of amusement and education. By a process of combination, in 1914, he developed a machine which would not only show the moving pictures but present dialogue to accompany the action of the plot. This machine showed defects, and it was recalled to undergo further study and experimentation.

Edison's industry in invention is well illustrated in his development of the storage battery that bears his name. After a long series of tests, when the storage battery appeared to be a success, it was put on the market, but Edison continued to experiment with a view to improving it. After several thousand cells had been sold it was found that occasionally a cell would prove defective. The customers were satisfied, but Edison was not. He shut down the factory, though it meant great loss, and for five years conducted experiments with the determination to improve it. The result was even better than he expected, and again the Edison battery was put on the market.

In the field of telegraphy Edison invented systems of duplex, then quadruplex and finally sextuplex transmission; this means that two, four and now six messages can be sent over one wire at the same time. In the telephone field Edison is the inventor of the carbon transmitter, which in a modified form is used to-day in practically all telephone systems. After the beginning of the War of the Nations in 1914 Edison devoted considerable time to perfecting processes for making carbolic acid, benzol and other materials previously imported from Europe and not manufactured in America.

The number of Edison's patents is more than 2,500; about 1,400 of these are registered in the United States, and nearly 1,200 in other countries. His laboratories and factories are in Orange, N. J., a few miles west of New York City. Edison belongs not to the United States alone, but to the world, and his modestly-won honors are from many nations. In 1878, when his genius was in what proved its early stages of development, he was given the appointment of Chevalier of the Legion of Honor from France, and fourteen years later was made a Commander in the same Order. In 1892 Great Britain honored him with the Albert Medal of the Society of Arts. In 1915 he received the Nobel Prize for physics, and was also appointed chairman of the Advisory Board of civilian inventors and engineers to consider plans for raising the efficiency of the United States navy. While he appreciates the honors bestowed on him he will never wear medals, for a characteristic of Edison is his dislike of display. Often visitors who have taken medals to him have been met with what appeared to be scant courtesy. At one time a visitor called at his laboratory with a medal to present to Mr. Edison and asked him if he had any more. "Oh yes," he replied, "I have a couple of quarts more up at the house." His apparent

bluntness meant only that his work was of more importance to him than any number of medals. W.F.Z.

Consult Jones's *Thomas Edison;* Dyer and Martin's *Edison: His Life and Inventions.*

Related Subjects. The importance of Edison's work can be best appreciated through a study of the following articles in these volumes:

Dynamo	Nobel Prize
Electric Light	Talking Machine
Electric Railway	Telegraph
Moving Pictures	Telephone

EDMONTON, *ed'mun tun,* the capital of the Canadian province of Alberta, one of the great cities which have sprung up on the western prairies almost in a day. For more than a century Edmonton was a trading post. It was prosperous enough, considered as a trading post merely, but it made almost no advance in size or importance. During the closing years of the nineteenth century there came a sudden change, and from a cluster of buildings scarcely worthy the name of village Edmonton was transformed into an important town. In another decade it became a great city—with the exception of Calgary, its rival to the south, the largest between Winnipeg and the Pacific coast.

It is a city with wide streets and boulevards, with fine homes and substantial business blocks, with banks, hotels, theaters, churches, colleges and excellent public schools, with railways, street cars and automobiles. In short, a city with all the comforts and advantages of modern life blossomed forth from the little trading post which stood on the banks of the Saskatchewan, a rendezvous for Indians and the few white men who carried on the business of the Hudson's Bay Company. From a population of 1,200 in 1899, Edmonton jumped to 2,626 in 1901, to 24,900 in 1911 and to an estimated total of about 70,000 in 1914. The War of the Nations made heavy calls on the city's population, which in 1916 was 53,794.

Location and General Description. Edmonton lies slightly south and east of the geographical center of the province, but is well to the north of the center of population. The preponderance of population in the south and south center, due to earlier railway development in these sections, has caused Edmonton to be considered as situated far north, but in reality it is well within the southern half of the province. It is about as far north of the equator as Berlin, Germany, and is slightly farther north than London, England. The city lies on the banks of the North Saskatchewan River, which at this point has cut a valley 200 feet deep and nearly a mile wide. The river itself is nearly 700 feet wide. On the table-land which overlooks the thickly-wooded river valley lies Edmonton. Edmonton South, that portion of the city south of the river, was formerly a separate city, called Strathcona, but since February, 1912, has been incorporated as a part of Greater Edmonton.

The Basis of Edmonton's Growth. The Saskatchewan River is navigable for steamers from Edmonton to a point about four miles above its mouth in Lake Winnipeg, a distance of about 850 miles. A series of rapids at that point breaks the course of navigation and has retarded the development of river traffic. Edmonton's prosperity is due largely to the railways. The Canadian Pacific, the first railway to cross the prairies, ran through Calgary, 194 miles to the south, and it was not until 1891 that a branch was extended from Calgary northward. This branch stopped at South Edmonton, on the south bank of the Saskatchewan. The Canadian Northern, the first railway to reach Edmonton proper, arrived in 1905, and in 1910 came the Grand Trunk Pacific. Two other railways, not yet completed, will open new territory tributary to Edmonton and also provide additional lines to the Pacific coast; these are the Edmonton, Dunvegan & British Columbia and the Alberta & Great Waterways railways. By the shortest rail routes Edmonton is 793 miles northwest of Winnipeg and 773 miles northeast of Vancouver.

Industries and Commerce. Edmonton is both a manufacturing and a commercial center. Its chief industrial plants are slaughter- and packing-houses, lumber mills, flour mills, foundries and machine shops. Coal mining, near the city and even within the city limits, has grown to great proportions. To a large degree the city trades in the products of its mills and factories, but it is also a large distributor of machinery and other supplies for the mines and farms. Edmonton is the natural commercial center for the valley of the Peace River (which see). It is also one of the world's greatest fur markets, being the headquarters of the Hudson's Bay Company, of Revillon Frères, a great French firm, and other smaller organizations.

Conspicuous Features. The city is a noted educational center, the chief institutions being the University of Alberta (which see), and Robertson and Alberta colleges, which are affiliated with the University, and the Jesuit and

Oblate Fathers' colleges. The public schools are well housed and equipped; such buildings as the Victoria High School and the John A. McDougall School might well be the pride of cities many times as large. The Edmonton Technical School deserves special mention. Of the many public structures the most conspicuous is the beautiful provincial Parliament building (for illustration, see ALBERTA, page 157), but also worthy of notice are the new Government House (Glenora); the Chateau Macdonald, a magnificent hotel completed in 1914 at a cost of $2,000,000; the courthouse; the civic block, which houses all the administrative offices of the city, and the McLeod building.

Edmonton is conspicuous among Canadian cities as one of the leaders in governmental reforms. It owns and operates all of its public utilities, including street railways, water works and telephone, electric light and power systems. It raises its public funds by a "single tax"; with the exception of a few license fees and special taxes for local improvements the only tax levied is on land. It has a modified commission government, the mayor being assisted by one city commissioner. One of the latest innovations, established in 1916, is a special court, presided over by a woman judge, to hear cases in which women and children are the culprits.

History. Fort Edmonton, a trading post of the Northwest Company, was established about 1795, and a few years later the Hudson's Bay Company established a station near-by. A small settlement grew up, but gave few indications of its future greatness. In 1876 the telegraph reached Edmonton, and in 1880 the first newspaper, the Edmonton *Bulletin*, was established. The small hand press, on which this first paper was printed, was brought across the plains from Winnipeg in a Red River cart, a vehicle usually made entirely of wood, drawn by an ox or an Indian pony and creaking horribly as its wooden wheels turned on its wooden axles after the rough trails had worn away the grease. The completion of the railway from Calgary in 1891 was of great importance, but is overshadowed by the fame Edmonton won in 1897 and later years as an outfitting point for the goldseekers who thronged to the Yukon and Alaska. In 1905 the city became the capital of the new province of Alberta. J.MC C.

ED'MUNDS, GEORGE FRANKLIN (1828-), an American statesman and great constitutional lawyer, was born at Richmond, Vt. He began the practice of law in 1849 and in 1851 removed to Burlington. From 1854 to 1860 he was a member of the Vermont legislature, being for the last three years the speaker of the house. In 1866 he took his seat in the United States Senate as a Republican from Vermont and was returned to that body for four successive terms, succeeding Vice-President Arthur as president *pro tempore* of the Senate after Arthur was elevated to the Presidency by the death of President Garfield, in September, 1881.

During his long term in the Senate he served on the most important committees, taking high rank as a statesman. He came into unusual prominence as the champion of a bill passed in March, 1882, for the suppression of polygamy in Utah. In 1880 and 1884 he was an unsuccessful candidate for the Republican Presidential nomination. He was the author of the anti-trust law, known as the Sherman Act, which was passed in 1890 and became one of the most important Congressional measures of the last half of the nineteenth century.

ED'MUNDSTON, the county town of Madawaska County, New Brunswick, in the northwest part of the province, at the confluence of the Madawaska and Saint John rivers, the latter being at this point the boundary between Maine and New Brunswick. The town is served by the Canadian Pacific, Grand Trunk Pacific and Temiscouata railways, and on the American side of the river is the Bangor & Aroostook Railway. The river valleys north and west of Edmundston are lumbering regions, and the town's chief industrial establishments are saw mills. There is also a large repair shop maintained by the Grand Trunk Pacific Railway. Mixed farming is carried on in the neighborhood, and good fishing and hunting abound. French-Canadians predominate in the town and vicinity. Population, in 1911, 1,821; in 1916, about 2,600. J.A.B.

EDOM, *e'dum*, a mountainous region mentioned in the Old Testament, located in modern Syria, lying on both sides of the River Arabah and extending from the southern part of the Dead Sea to the Gulf of Akabah. The country was called Mount Seir until the Edomites, the descendants of Esau, drove out the Horites and occupied the land themselves. It is noted for its red sandstone cliffs, and some have thought that the name *Edom*, which means *red*, was given to the country because of the color of the cliffs.

EDUCATION, *ed u ka' shun*. Ever since man appeared upon the earth the race has struggled to overcome its environment, and the progress from savagery to the present state of civilization of the most enlightened peoples is due to this struggle. Education, in the broadest meaning of the term, means the development of all the powers of man; in the restricted sense in which the term is ordinarily used, it means the training of children, youth and adults in educational institutions—common schools, colleges, universities and professional schools. In the broadest application of the term, education extends through life; in its restricted application, it is confined to the school age, which may extend from four to twenty-five years, if the kindergarten and professional schools are included.

A study of the definitions of education shows that theories and systems have undergone radical changes during the last century. The older definitions emphasize the idea of education through external conditions and powers. The modern definitions, while recognizing the value and influence of these conditions and powers, place emphasis upon the necessity of the self-activity of the learner. In other words, it is only as the learner himself uses these conditions that he becomes educated, through their influence. The educational systems of the past are of interest only to those who desire to study the evolution of educational systems; there are many volumes devoted to this phase. The modern tendencies of education are of present interest, and are set forth in the subtitles which follow.

Natural Education

The term *natural education* is applied by Winifred Sackville Stoner to a volume in which she gives in detail the methods employed in the early instruction of her daughter Winifred (see STONER, WINIFRED SACKVILLE). It has attracted widespread attention because of the very early age at which the child mastered the studies taught in the elementary and high schools, including several foreign languages, and also a number of accomplishments such as playing the piano and violin, painting, and boxing and fencing. The term is now used by Mrs. Stoner to designate her methods, which she holds are better adapted to child nature than those ordinarily employed in school instruction. She has established several schools in which her methods are being applied, and she has thus summarized these measures:

The name *natural education* has been chosen deliberately to designate a new sort of education, the kind which Nature surely intended for all her children—education through play, directed toward a definite end throughout life. All children and all grown people love play, but they restrict the word to a much narrower meaning than is either necessary or desirable. Play is a word that should be made to include anything which one does under the leadership of interest. To be compelled to study or to engage in certain occupations when interest is utterly lacking, is *work*. If the interest is sharply engaged, it is *play*. The pathway of knowledge for children should be one of joy and not one of drudgery. But in order to give little ones a thirst for knowledge, in order to stimulate and not to dull the eager curiosity which every normal child has from birth, training can hardly begin at too early an age.

And since the schools do not care for children during the earliest and probably the most impressionable years, this, their first education, is in the hands of the parents. Now, parents need to be trained for the task. They cannot go at it blindly or they will falter. There must be schools for parenthood so that both young men and young women may learn how best to care for their babes. There should be parenthood training classes in every high school and every college, where all young people could be trained to realize the joys and rich

possibilities that come through fatherhood and motherhood.

Mother Nature has seen to it that her children shall care more for babies than for their studies of the many "ologies" and "isms," for she has put into the heart of every human being the mother love and the father love that make them care tenderly for their children. Plants and animals do not develop best when they are allowed to grow like weeds. All the time and thought put into cultivating them produces a finer product. Why, then, should children be allowed to grow like weeds during their most impressionable years? It is wasting precious opportunities to neglect them for the first six years of their lives and then to deliver them for training to the overworked school teacher.

Every normal child born into this world is a trinity—mental, physical, moral—and every part of that trinity should be developed while the mind is like wax and the impressions made on it are lasting. The mother who develops only the physical part of this trinity makes of her child a sturdy little savage. The parent who develops the mental at the expense of the physical goes against the laws of nature and is sometimes rewarded by a replica of the old-time literary celebrity with begoggled eyes, bent back, contracted chest, and pale, sad countenance. Other parents are blind enough to develop the moral and spiritual side of their children at the expense of the mental and physical. All three are wrong. Let moderation in all things be the watchword of parents.

Every normal child born into this world has some special talent given to him, some aptitude for a particular art or profession or occupation. "Why, then," some will ask, "are there not more famous people in the world?" Just as a multitude of good things can be attributed to mothers, so must these same mothers shoulder the blame for many omissions. They should be alert for signs of their children's talents at an early age, ready to nurture them until they bear glorious fruit. The school age, six years, is all too late. Earlier development will do much to bring out this talent; for the child's mind has all the foundations for good or ill, greatness or lowliness, before the school age, and parents must see to it that the foundations are strengthened, not undermined.

History tells us that nearly all great men have shown signs of their wonderful talents almost in babyhood. Julius Caesar was only three years old when he rode to war behind his Uncle Marius. Napoleon played his childish games with imaginary warriors, and Alexander the Great, when his father was absent, went out to parley with the ambassadors. Confucius played on the lute and talked of piety when he was a mere babe, and John Stuart Mill was hardly older when he knew the Latin and Greek alphabets. The exceptions to this rule early rebelled against school and the uninteresting quality of their studies, and, if we knew more of their early lives, we would probably find that there was some just cause for their rebellion—some reason why the fairy, "Interest," was not present to make play of their work.

Children from two and a half to three years of age are at their keenest, bubbling over with energy and curiosity. It is almost criminal to allow this interest and curiosity to spend itself without results. This is the period when the most promising children are likely to leave destruction in their pathway simply because their excessive energy is undirected. Play, as we know it, is not enough. Play without a purpose is mere idleness, and Nature never intended any of us for idleness. But play with a purpose, well-directed play that develops all of a child's capacities, physical, mental, spiritual, will benefit both the child and those about him.

Nature has endowed the child with an eager curiosity, with a desire to touch and taste and handle everything around him, and, as soon as he has acquired the art of speech, to ask innumerable questions. These questions should be answered by mothers and fathers. It requires intelligence and quick thinking and infinite patience to satisfy the thirst for knowledge that children possess, but it is a duty that cannot be shirked. Mothers of the animal kingdom train their young to do all the things that they themselves can do. How many mothers of our race have the patience to do as much? How many of them are as painstaking as is mother Tabby with her kittens? And if their failure is due to their inability to answer all the questions, then they must seek to acquire more knowledge. It is their duty to go to the books, which are still closed to very young children, and there to find answers for them. What are books for—the encyclopedias and the dictionaries, all the stored-up knowledge of the ages—if they cannot tell the child, through his parents, what he wishes to know? Such study serves a twofold purpose, for parents cannot gain the knowledge they wish their

children to have without at the same time benefiting themselves. This is directly in line with one of the Natural Education principles, "We know that which we impart."

Natural Education is not a stuffing process, but one of its purposes is to fill children's minds with thoughts worth remembering at a time when they can memorize with the greatest ease—that is, from the second to the twelfth year. Winifred Stoner was given a useful store of information, or at least a foundation on which she could reason, before she reached her thirteenth year. When she entered the adolescent period she was allowed to follow her own inclinations as regards study.

Most children in the adolescent period are in the high school, at work which is much more difficult for them than any they have had previously. During this time of life, when they are neither little folks nor grown-ups; when they are in a dreamy rather than an active state; when they are changing from grubs to butterflies, they should not be forced to study. The information which seems to them dull and uninteresting might all have been given to them before this time. They might have acquired in early childhood the knowledge which, during their high school years, they feel it drudgery to gain.

But education of this sort cannot be given in large classes. Individual training is the ideal—training through which knowledge may be gained in a few months which now requires years of time. There are no two things exactly alike, not even two leaves on a tree or two blades of grass. Why, then, should we expect children to be so much alike that our son should be made to learn all things and to do all things in exactly the same way in which our neighbor's son learns them and does them?

Nature never intended that her children should be put within brick walls, as if they were prisoners, when they are gaining knowledge. It is all wrong. The day will come when the closed schoolroom will be the exception and the out-of-door school, the rule. Nothing in nature is static; everything is dynamic. Why, then, should we have stationary desks and other immovable furniture in the schoolroom? Why should children be compelled to have thirty minutes of geography, then thirty minutes of arithmetic, and so on, at stated times each day? Monotony such as this kills interest, and when interest is gone the acquisition of knowledge becomes painful drudgery. It should be a joy.

Why not introduce games into the public schools which will be so interesting that children will play them after school hours and during vacations—games that will develop both mind and body? Such games would necessitate more playgrounds, to be sure, but the more playgrounds we have the less need there will be for penitentiaries.

All children have a sense of rhythm that expresses itself when they are very young, in their love of nursery rhymes and jingles. Learning, put into jingle form, is much more easily remembered than in the form of prose. Have you never begun the jingle, "Thirty days hath September, April, June and November," when you wanted to be sure of the number of days in a particular month? This is a perfect illustration of the point. There is no reason why all sorts of facts which will be useful throughout life cannot be put into just such form. And the singing of the rhymes and jingles may be accompanied by body rhythms, so that the mental and the physical can go hand in hand, bringing about perfect coördination of mind and muscle. In other words, make a game of the jingles, an active, interesting game.

It is not necessary to buy expensive and elaborate tools and toys for children. The same old dolls and balls and hoops which have always been in the nursery can be used as aids in developing the imagination, teaching rhythm, history, poetry, art. All toys should, however, be of the constructive type. But beware of the destructive toy! Mothers who give their little ones toy swords and pistols are helping to keep alive the war spirit, that menace to civilization. Children must be taught to admire the constructive rather than the destructive, the saver of life rather than the taker. Let school-books contain, not nine-tenths praise for the warrior and one-tenth for the great inventor or artist or poet, but the reverse. Let children be taught to revere the high achievements of peace and not the accomplishments of war.

The best toy that any child can have, a veritable fairy toy, is a typewriter. No better means can be furnished a child for learning to read, to spell, to speak and write good English, to punctuate and to memorize. If he learns to operate his machine well he will develop his hands so that he will not have the same difficulty in playing a piano or a stringed instrument as he would if he came to it with untrained muscles. He may easily teach him-

self to read by means of this good fairy by copying simple lessons from interesting children's books. It is essential that everyone learn to do things for himself, and a typewriter encourages a child to dig out words and to learn their meanings. It teaches concentration and observation. It teaches accuracy. Children rapidly learn to find the punctuation signs, to know them by name, and to use them. Later on, when the child has learned to write with more facility, he may copy thoughts in verse and prose from the great masters, and thus he gets a mental picture which will never be forgotten. In the same way, and without studying in the regulation manner from a spelling book, he will learn to spell. He will probably enjoy drill of all sorts on the machine. And if he makes a mistake in English and his mother or teacher calls his attention to it, the task of writing the correct sentence ten times on the machine will fix it in his memory so that he cannot forget it.

After a child has learned to know the printed letters he can be taught the script letters very easily. Set him to copying the letters singly, just as he would copy a picture, until he has them fixed in his mind. When he begins consciously to learn to write he will find it much easier than will the child who has never become familiar with the picture of *a, b, c,* etc.

Hurry, worry and fear should be driven from the schoolroom, and, in fact, from all paths leading to knowledge. Children should be given fewer tasks, and that relic of inquisitional torture, the examination, should be absolutely banished. Who knows how many nervous wrecks it has been responsible for? If children learn to study for the sheer love of gaining knowledge and not for the sake of winning deportment cards and bits of sheepskin, examinations will have no further usefulness. Let a teacher only arouse a child's thirst for knowledge, show him how to travel to the "knowledge fount," and he may safely be left to his journey. No prodding will be necessary.

As we study Nature and people, education seems to narrow down to two real objects—self-control and the joy of service. Tiny babies can be taught to control themselves. Alexander the Great conquered worlds—and died without having learned self-control. No wise mother had trained him from the first for the conquest of himself. All children get their first lessons by imitation. How then can they learn to master themselves if those about them *lack* poise and perfect control? See to it that your children have before them a splendid example to imitate.

Tiny children soon learn the joy of service. They scarcely need to be taught, rather they only need to be encouraged, to do little acts which will bring pleasure to those around them; and by giving joy they make gladness for themselves. Let us all learn that one of the joys of achievement is the realization that we can do more for others; and let children learn to do a variety of things. To master one thing is essential, but, in addition, let them be "jacks of all trades." Thus and only thus can an all-around development be secured.

All languages should be taught to children in that same memory period, between the ages of two and twelve, and through the natural or direct route—that is, through the ear rather than the eye. Children under twelve years learn to speak foreign languages very quickly, whereas, if they wait until the high-school age before they make the attempt, and in addition try to learn languages through the grammar route, interest vanishes and the work brings weariness and unhappiness into the student's life. Children should get their first impressions of music in the same way—through the ear. It is absurd to imagine that the music reaches the soul through the eye, yet this is what many a music teacher seems to believe.

Mathematics, the *bete noir* of many children's lives, can also be made a joy, by treating it as the science of quantity, not in separate divisions of arithmetic (through many problems), algebra (more problems), and geometry, a stern, brain-nagging study. Children should be given some idea of all branches of mathematics from the beginning. Teach them to observe the geometrical figures that adorn many public buildings; let them become familiar with various geometrical forms by playing hexagon tag, pentagon tag, and similar games. Point out the fact that their hop scotch pen is made up of rectangles. Tell them that their balls are spheres and their blocks cubes. Do not make them work out problems in arithmetic. Give them a typical problem, and after they have mastered the principle let them make their other problems for themselves.

Develop their imaginations, that gift of the gods, by giving them all sorts of imaginative play. Let them tell stories and act them out. Let them make plays out of the stories of history or invent their own plays to fit the music and poetry and dancing that they love.

Let every game have some definite purpose. In fact, see that everything the child does is for a purpose. When he writes a letter let him send it to a friend. If he writes a story, preserve it for him in a note book. Make him keep a general information book and show him how to seek out information in the dictionary and other books of reference, and put it down.

As to discipline, there is no need of it in a home where Natural Education ideas are followed out. Mischievousness is only misdirected or undirected energy. The child who is kept busy to a purpose is always happy, and happy people are never bad.

The following principles are given to express briefly and concisely the aims of Natural Education:

Education from the cradle to the grave.

Training for parenthood.

Development of the child's mental-physical-spiritual trinity in the cradle.

Development of every normal child's talent by the parent.

Children taught how to play to a purpose.

Development of the five senses to serve as body protectors.

Children encouraged to use Nature's information seeker—the question.

Parents encouraged to answer children's questions.

Developing the imaginative or creative faculty above everything.

Using Mother Nature as the first teacher.

Encouraging expression instead of repression.

Encouraging children to teach what they have been taught.

Training each child as an individual and not in a class.

Giving children constructive instead of destructive toys and teaching them to admire the giver of life rather than the taker.

Filling the child's mind with beautiful thoughts in the memory period (five to twelve) so that when the age of reason begins at twelve years he will have something worth while upon which to reason.

Teaching all languages by the natural method before the twelfth year.

Teaching music through training of the ear before the eye.

Teaching important facts through jingles.

Giving practical knowledge to make efficient citizens.

Doing away with examinations through using interesting children's books.

Giving teachers higher salaries, shorter hours and fewer pupils.

Encouraging the nurturing instinct in the young through making gardens and taking care of younger children.

Using Esperanto to teach the roots of modern languages and to provide each child with an international medium of communication.

Teaching how to read, spell, punctuate, speak good English and memorize by using the typewriter.

Keeping the fairies, Love, Sympathy, Good Cheer, in the home and school.

Banishing the demons Hurry, Worry, Fear.

Obliterating "I Can't" from vocabularies and using "I'll Try."

Having high ideals.

Laying the five foundation stones of education, Observation, Intense Interest, Concentration, Imitation, Exploration, and seeking to become educated in the highest sense through learning.

Self-control and the joy of service. W.S.S.

Measuring Results of Education

For a long time education was a matter of individual concern. The parent selected a teacher or an educational institution as a matter of individual choice. He had in mind certain things which he wished his child to accomplish. He sought for a school which was calculated to give to his child just the accomplishments which he wanted. He employed the teacher or the institution to render this special service. If he was dissatisfied for any reason, the service was discontinued. Parents who did not care for their children to be "educated" were not especially concerned with the teacher or the institution, since they were neither patrons nor supporters. Consequently, it was necessary for the teacher or the school to satisfy only the pupil or the parent. The relationship was personal and intimate. The work was being evaluated every day by the teacher, the child and the parent.

With this simple voluntary arrangement there was little question about elaborate systems of measurement of result. The worth of the school or the teacher was measured on the basis of certain personal qualities. The common questions were, Do you "like" the teacher? Do you "like" the school? Is your teacher "kind"? These questions were all more or less subjective. The answers rested upon a somewhat intimate relationship; in case they were unsatisfactory the remedy was simple.

With the development of the tax-supported school system and compulsory education legislation, came new problems. Billions of dollars are being expended now for the purpose of safeguarding oncoming generations. The parent no longer has the option of deciding whether his child shall go to school. He no longer has the option of selecting his child's teacher, or even a particular school.

The New Relation Between Teachers and Parents. Society as a whole, through its delegated authority, selects the teacher, selects the text-books, and determines the standards of the school. The relationship between the modern school and the individual parent has become more or less impersonal. Indeed, the whole movement of parent-teachers associations of the present day is an expression of a desire to restore this warm personal relationship between the parent and the teacher (see PARENT-TEACHER ASSOCIATION). In the United States alone there are to-day nearly 700,000 teachers. It is estimated that there are more than 100,000 vacancies each year, which means that there are more than 100,000 teachers who are new to their particular tasks. There are also many thousands of teachers who propose to stop teaching at the end of each year. Among the other half-million teachers, many have taught only one or two years. With all these variations in experience and mental attitude on the part of the teachers, it is small wonder that there is great difficulty in determining proper standards of preparation of the children throughout the grades.

The Need for Standards of Achievement. Among the many questions of standards which arise are those in regard to the mental expectancy for children on entering a particular grade. How much more should we expect after a child has been in school one year, or two years, or five years? How well do the children add, read or write? How much history should they know? These questions demand a more adequate system of measurement than the personal opinion of teachers with a limited amount of experience and training. It is not enough to say that the child is "poor" in reading, or "good" in adding, or "excellent" in penmanship, unless we know something of the standard of excellence in the mind of the teacher. It is not enough to ask whether or not the child is "good," or "well-behaved," or that his parents are "reasonable," or whether the child "likes" the teacher. It is not enough to report that the children "study" or that they are "industrious." Now that society requires that a parent place his child under a particular teacher, in a particular school, it is only right that he should know whether or not teacher and school are efficient.

As these questions have become more and more insistent, the schools have come more and more to demand means of measuring educational attainment; means of measuring educational progress; means of measuring teaching efficiency. In answering these questions students of the science of education have been influenced by the great development of measurements in other types of activity, as agriculture, medicine or business.

With the introduction of cost accounting systems on farms, in stores and in factories, it is to be expected that the public will demand a more definite system of school accounting, a more adequate system of measurement of educational results. As a matter of fact, the demand for such measurements has been parallel to the demand for measurement in all other fields.

Methods of Grouping Pupils. The attempts to grade children in the schools which have been made in recent years express the school administrator's desire to measure the educational progress of children. Among the various attempts at grouping children might be mentioned the scheme of grouping children on the basis of age, size, years in school and mental maturity. Certain attempts have been made at grouping children of the same age together, others of the same size, others of the same number of years in school, others of the same mental maturity. The seating arrangements in the old-fashioned school furnished evidence of the fact that children were not infrequently sorted on the basis of size. The scheme of grouping children in seven, eight or nine grades on the basis of the number of years they have been in school is a later attempt at a satisfactory grouping. The present ideal is to group children so as to have them of as nearly the same degree of mental maturity as possible, irrespective of the number of years in school, or of size or age.

Educators realize that children of the same size are not necessarily of the same degree of mental maturity. Neither are children who have been in school the same number of years of the same degree of mental maturity. Indeed, the investigations which have been made in recent years show marked variability in this particular. The records in some cities show that as many as seventy-five per cent of the children have been unable to do the required work in the allotted time. Modern educators have provided adjustable seats so as to make it possible to provide a flexible system of seating. They have likewise attempted to work out new schemes of promotion, such as the semi-annual promotion, in order to provide an adaptable system of caring for the

children of different degrees of educational progress.

Many of the earlier and more crude standards of measuring the educational progress of children still prevail. One of the best examples is the use of text-books which are theoretically graded so as to mark the progress of the children. The use of the text-books in reading is a case in point. Here the editors designate the gradation by a series of titles such as First Readers, Second Readers, Third Readers, and so on. Unfortunately editors of reading text-books have rarely known enough about the progress of the children to be able to issue the final verdict in connection with reading ability.

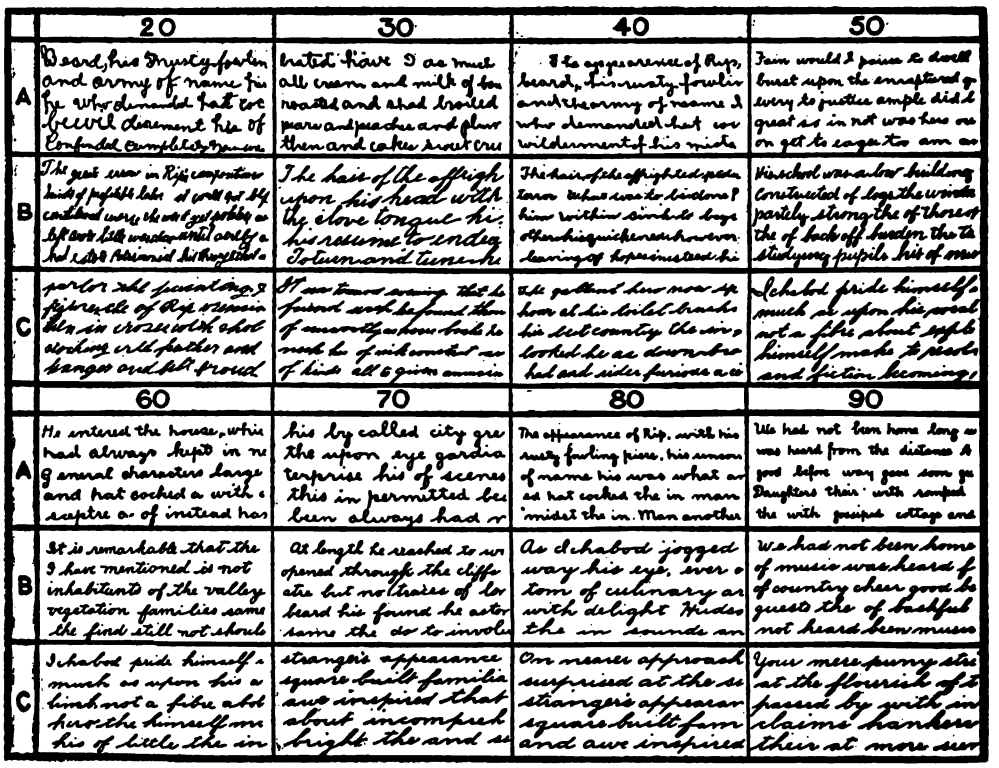
Variations in Standards of Promotion. The theory of promotion from one grade to the next has been that the work of one grade would prepare a child to do the work of the next. One of the difficult problems in connection with this system has been the inability of the teacher to know what to expect of a child in a particular grade. The teacher in a particular grade has often been ignorant as to how much or what to expect of the children in her own grade. She has also frequently been ignorant of what the teacher would expect of her children in the grade following. Some teachers in their desire to be thorough and to escape criticism from the teachers in the grade beyond set an unreasonably high standard, refusing to promote any but those able to meet this unreasonable standard. Others set up too low a standard of promotion, so that when the children are promoted they are unable to do the work required of them. These variations in standards for promotion have become so obvious as to be the cause of no little concern in the minds of teachers and school administrators.

The attempts to measure the progress of children throughout the grades made by Thorndike, Ayres, Blan, Strayer and others not only have served to call the attention of the general public to the necessity for a more adequate system of measurement of what to expect of the children from grade to grade and from subject to subject, but they have helped to meet the situation suggested above.

Dr. Blan found that wide variation existed in different sections in regard to the number of children who failed of promotion in certain grades. For example, 30.8 per cent of the eighth-grade pupils of one city had failed of promotion in the first grade; whereas, in another only 1.2 per cent of the children in the eighth grade had failed in the first grade. This indicated that in the first city a different standard of attainment was held for the children in the first grade, or the children of the first grade were of an inferior type. It is not likely that the latter is as satisfactory an explanation as the former. In all probability it is due to the fact that there are different degrees of ability in the measurement of the work in the first grade in the two cities, as well as differences in standards of attainment to be expected of first-grade children in the two cities. Dr. Blan found in general that "the pupils find the lower much easier than the upper grades." This difficulty of properly grading the work of the different grades is partially due to the fact that the schools have not adequately done the work to be accomplished in the different grades.

Why Educational Measurement Is Necessary. The demand for adequate educational measurement has come about through the desire to throw light on these and similar questions. The superintendent has found it necessary to ask the fourth-grade teacher, for example, what she expected of her children in spelling, penmanship, arithmetic and reading. He has asked her whether or not the standard of attainment in her grade has been as high as in a similar grade in New York, in Boston, Detroit, or in neighboring cities. The answers to these questions are highly desirable in view of the fact that the work of the schools is being constantly evaluated by the public. Children leave one school to go to another, or go out into the world. There should be a clear understanding of the expectation of performance on the part of a child in the various fundamental subjects. By means of educational measurement it should be possible for us to determine whether or not a child in a particular grade is able to read, to write or to cipher as well as we have a right to expect him to do.

Measurement of Handwriting. One of the earliest attempts at the measurement of handwriting was made by Professor Thorndike, of Columbia University. He secured thousands of samples of handwriting, which he afterwards had rated on general merit by a large number of competent judges. Each judge was asked to distribute the samples into a series of groups, based on the least noticeable differences, the best papers in one pile, the next best in another pile, and so on. Building on the composite judgment of a large number of these judges, Professor Thorndike constructed his handwrit-



MEASURING SCALE FOR HANDWRITING

To measure the quality of a sample of handwriting, slide it along the scale until a writing of corresponding quality is found. The number in black represents the value of the writing being measured.

(Chart provided by Leonard P. Ayres, Russell Sage Foundation, New York City.)

ing scale, which consists of a series of samples of handwriting ranged in merit from quality eighteen, which is artificially perfect copper plate, to quality one, which represents zero in handwriting merit.

The Ayres scale, though not the first handwriting scale made, is in general use throughout the country. Dr. Leonard P. Ayres developed this scale on the basis of legibility. By means of an accurate system of time checks, he determined the length of time necessary in order to read certain specimens of handwriting. Specimens were then selected so as to form a graded series of increasing legibility.

The teacher who wishes to measure the writing in her room by the Ayres scale may compare the samples of handwriting of each of her pupils with each quality on the scale. For example, let us suppose that a teacher of the sixth grade has thirty children. After comparing the handwriting of each of these pupils with each sample on the accompanying scale, she finds that she has one pupil whose writing *is* most like quality twenty; five that are most like quality thirty; seven that are most like quality forty; ten that are most like quality fifty, and so on. She is now interested in knowing how this handwriting compares with the handwriting of other children in the same grade in the United States. Many teachers measure the handwriting of each child at the beginning and the end of the term; thus they are able to tell the exact progress that each child has made in the meantime. Many high school principals establish the standard of handwriting required in the school, with the understanding that written work handed in by the children will be measured by use of the scale. The children who fall below the standard take special instruction in handwriting.

Millions of samples of handwriting have been measured by means of these scales, so that it is possible for any teacher to evaluate the work her children are doing in penmanship, both as to quality and as to speed, as compared with the work of other children, elsewhere. By this means it is possible for the efficiency of penmanship instruction to be determined.

Dr. Frank N. Freeman of the University of Chicago, after an exhaustive analysis of public school writing, proposed the following standard of quality and speed, as measured by the Ayres scale:

Freeman's Standard

Grade	II	III	IV	V	VI	VII	VIII
Quality	44	47	50	55	59	64	70
Speed	36	48	56	65	72	80	90

This table means that the average child in the second grade should write a quality 44 on the Ayres scale at the rate of 36 letters per minute; a quality 47 at a speed of 48 letters per minute, in the third grade; a quality 50 at a speed of 56, in the fourth grade, and so on.

Dr. Starch of the University of Wisconsin proposed the following standard, based on over four thousand samples:

Starch's Standard

Grade	II	III	IV	V	VI	VII	VIII
Quality	27	33	37	43	47	53	57
Speed	31	38	47	57	65	75	83

This table means that the average child in the second grade ought to write a quality of 27 at a speed of 31 letters per minute. The average child in the third grade ought to write a quality of 33 at a speed of 38 letters per minute.

Ashbaugh and Newcomb made an analysis of 28,000 papers from 110 cities, towns and rural schools in Iowa and found the following standard:

Iowa Standard

Grade	II	III	IV	V	VI	VII	VIII
Quality	35.7	39.8	44.5	49.1	52.3	57.	61.
Speed	39.2	49.6	61.9	65.5	72.6	75.	76.5

This table means that in Iowa the average second-grade child wrote quality 35.7 at a speed of 39.2; the average third grade child wrote quality 39.8 at a speed of 49.6, and so on.

By utilizing such data it is possible for a teacher to measure the progress of her own instruction and compare it with instruction elsewhere.

Measurement of Composition and Arithmetic. In a similar way composition scales have been worked out by Dr. Milo B. Hilligas of Columbia University and by Dr. Frank Ballou of Harvard University. Many teachers have found the use of these helpful.

The result of instruction in arithmetic has been subjected to measurement for many years. Among the names most prominent in connection with the measurement of arithmetical results are Rice, Stone and Courtis. In 1902 Mr. Rice gave the same test under similar circumstances to more than 6,000 children in seven cities. He found a very wide range in the ability of children to respond to the same test. A few years later Dr. Stone gave an examination to pupils in the 6A grade in arithmetic in twenty-six cities; he also found a wide variation in arithmetical ability.

However, the most thoroughgoing attempt at measuring arithmetical ability has been made by Mr. S. A. Courtis. Mr. Courtis developed a series of tests so arranged as to stimulate each child to do his utmost in a given time.

The teacher who gives these tests fixes the time limit in accordance with the directions of the test; for example, eight minutes is the limit for addition. At the time of the test each child is supplied with a booklet on which are blank spaces, calling for his name, age, grade, etc. On the body of the page is printed a series of problems, like the examples below:

Add:	982	356
	347	235
	236	872
	328	543
	456	271
	723	890
	897	397
	416	428
	648	756

The page is filled with this type of problems and at a given signal each child begins to add. At the close of eight minutes, time is called, the material is then graded on the basis of the number of problems attempted, and on the number of problems successfully solved. Similar tests are provided in subtraction, multiplication and division. Hundreds of thousands of these tests have been given to children in the fourth, fifth, sixth, seventh and eighth grades, in large cities and in small cities. Indeed, it is now possible for a teacher in any grade from the fourth to the eighth to determine whether or not her children are able to add, multiply and divide as well as are children in the same grade elsewhere.

Standard Scores

Grade	Test 1 Addition	Test 2 Subtraction	Test 3 Multiplication	Test 4 Division
III	3	4	3	2
IV.....	5	6	5	4
V.....	7	8	7	6
VI.....	9	10	9	8
VII....	11	11	10	10
VIII...	12	12	11	11

Standard accuracy = 100 per cent.

Measurement of Reading and Spelling. Tests for measuring reading are being rapidly developed. Among the names most prominent in connection with the reading tests are Gray, Kelley, Jones, Courtis and Thorndike.

Spelling tests are likewise being standardized. Among the names in this connection are Ayres, Buckingham and Courtis. In measuring high school subjects, the names of Starch, Ballou, Monroe and Breslich stand out prominently.

Measurements a Check on Methods. Educational measurements are being used not only to check the gross efficiency of the teachers, but they are coming to be used more and more as a means of checking the effectiveness of certain methods. For example, it is possible by means of modern educational tests to measure the comparative efficiency of text-books or of different pedagogical methods. One of the best-known examples of the latter is found in the investigation of Mr. J. C. Brown, who by means of the Stone test measured the value of the three-minute daily drill period in the teaching of arithmetic. Mr. Brown and Mr. Pierson of the Horace Mann School measured the value of two different methods of teaching spelling by means of a spelling test. The investigations of Rice, Stone and Courtis agree that a large time expenditure is not necessarily associated with a high type of product, regardless of method.

Thus it may be seen that with the development of the technique of educational measurement, it is becoming more and more possible for schools to develop a high type of efficiency. Great interest is being shown in educational surveys; this is expressed in legislative demands for state-wide surveys, such as have been made in Ohio; surveys of higher education, as found in Wisconsin, Iowa, Washington and Missouri; surveys of city school systems as found in New York, Portland, Cleveland, Baltimore and San Francisco. The surveys are evidences of the fact that the citizen is becoming interested in getting an adequate measurement of education. Educators everywhere are responding to this demand by developing an elaborate technique for accomplishing this end. W.A.J.

Modern Tendencies in Education

There are many definitions of education—almost as many as there are men and women who have written books about education. Most of these definitions, however, may be reduced to one or the other of two general forms: In the first place, education may be looked upon as the process of directing or controlling the *natural growth* of the child; in the second place, education may be thought of as giving to the child some of the *knowledge* and *skill* that the race has acquired in its long experience. Those who emphasize natural growth as the fundamental factor in education will care for children very much as the good gardener cares for plants; that is, they will aim to provide opportunities for healthful and natural growth; they will find in the process of education a large and important place for *freedom;* they will let education follow the child's *interests* and *desires,* just as far as these can be safely trusted; and they will look with disfavor upon the use of *force* or *compulsion* in stimulating "learning."

On the other hand, those who view the passing on of knowledge and skill as the fundamental educational aim will not be likely to trust the child's interests and desires so far; [redacted] will see to it that the knowledge and the race has accumulated are well organized and made as palatable as it is possible to make them, but they will also insist that the child make an effort to learn, even if the lessons do not always appeal to him, and they will insist especially that the learning be undertaken systematically and progressively.

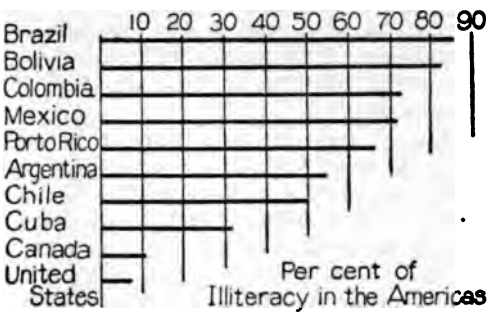
Education as Natural Growth. Modern education combines these two points of view, although the emphasis at the present time is rather more heavily upon "natural growth" than upon the systematic mastery of knowledge and skill. This is probably because knowledge and skill have been the important aims of the schools for centuries, while the claims of natural growth have been looked upon with favor only within a comparatively short time—although these claims have been recognized by students of education for centuries.

Probably the most important differences between modern education and the education of the past are to be found in the improved methods of teaching which have come with this recognition of the importance of natural growth. Modern education is not blind to the fact that children must master knowledge and acquire skill; in this respect, it accepts the older educational aim, but it does insist that this mastery shall make as much use as possible of the child's natural capacities for growth as

ated by his interests and desires. Perhaps ost important principle is that all learn- hat is to be at all effective must be based the child's own experience, and that any ipt to force the child to master something hich he has no basis of understanding or pretation in his own life is a waste of and effort. Hence one of the important ems that modern education has attempted lve is this problem of providing rich, con- individual experiences with actual situa- and actual objects, as a basis for the matic, "abstract" study.

e old-time school placed a book in the 's hands and forced him to memorize its nts with little reference to whether the s were really understood or not. Very ently the words were not understood, and learning" became nothing but a parrotlike ition of meaningless symbols. One finds ir schools of to-day occasional instances is barren and fruitless attempt at "educa- ' but the better schools condemn such ices, and good teachers make it their first ess to see to it that children have a basis tual experience for the knowledge they acquire. Sometimes the objects that are studied about are brought into the lroom; sometimes the children make ex- ns to the objects; the sand table and the ing board are used to reproduce in minia- actual situations; and when other forms ustration are not available, pictures are lly employed. The effort always is to the child actual experiences, and, failing to stimulate his imagination to the point e he can gain an adequate notion of what ctual things are like, and of how he might f he were face to face with them in an l situation.

at Educational "Experience" Means. It is insistence upon *real experience,* then, most clearly distinguishes modern educa- rom the education of the old-time school. the word *experience* is coming to have a and a richer meaning as the modern er works with the problem. When the y of having children memorize words had little or no meaning to them was recognized, some educators thought the lty could be overcome merely by having ts to illustrate the words. For example, ildren were studying about spheres and nids, it was thought sufficient to have l spheres and pyramids to be looked at andled; if dogs were to be studied, a real dog could be brought in; if the child was to understand what a "bushel" meant, he should look at and perhaps handle a bushel measure. This, indeed, was a marked advance over the parrotlike repetition of words, but after all it did not solve the problem of giving the pupil



Brazil, all ages, unable to write.
Bolivia, over 7, unable to write.
Colombia, males, all ages, unable to read.
Mexico, over 12, unable to write.
Porto Rico, over 10, unable to write.
Chile, over 10, unable to read.
Cuba, over 10, unable to read.
Canada, over 5, unable to write.
United States, over 10, unable to write.

"real experiences." Gradually, as teachers struggled with the task, an essential truth emerged: if an object is really to *mean* anything to the child it must have some connection with a vital "problem" which he has a strong desire to solve.

One may learn something about pyramids and spheres by looking at nicely-fashioned wooden models of these objects; one may learn something about dogs by looking at real dogs; and one may learn something about a bushel by looking at an empty bushel-measure. But one learns much more about these things if they have a definite relation to a life-problem. What dogs can eat, what must be done for them in the way of shelter and training, what precautions are to be taken if they are not to be carried away by the dog-catcher and incarcerated in the "pound"—these matters become of large significance and "meaning" if the child owns a dog of which he is very fond, and the protection and care of which may be made to appeal to him as a "real problem."

It is, of course, very difficult for the teacher or the parent to relate all of the knowledge and skill that the child must master to some real problem that is significant to the child's own life. Modern education has not thus far decreed that all knowledge must be passed on in this way. It has, however, set a high sanction upon teaching through "problems," and it has strongly insisted that the early basis of all

learning shall be laid in this way. After the beginning has been made, the normal child will be able to undertake the systematic and progressive mastery of recorded knowledge with a fair hope of success; but modern education believes that, even in the later stages, when knowledge can be assimilated in a somewhat "abstract" form, the use of this knowledge—its application to the solution of human problems—should always be an important phase of the teaching.

Emphasis upon the Social Phase of School Life. Another striking difference between modern education and the education of the past lies in the emphasis that is now being given to the *social,* or *group,* phases of school life. It was not so very long ago that practically all of the teaching in the lower schools was individual teaching; that is, although children were brought together and placed under the instruction of a teacher, the children did not participate as a group in the school exercises. On the contrary, the teacher called the pupils to him, one at a time, "heard" their lessons, and sent them back to their benches for independent work. The method of class instruction (or the "simultaneous" instruction of a group of pupils) was an important forward step, although, like many other forward steps, it had certain disadvantages. It is difficult, for example, to make class instruction meet the needs and the capacities of every member of a group. Some pupils are naturally "bright," others are naturally "slow"; class instruction tends to reduce them all to the same rate of progress, and this is likely to work an injustice both to the brighter pupils, who might proceed very much more rapidly, and to the slower children, who find themselves handicapped even by attempting a rate of progress which the average pupils can readily attain.

Several methods have been devised to overcome these difficulties of group-instruction: one plan employs two teachers for each classroom, and gives one teacher charge of the group-work, while the second teacher "coaches" the individuals who fall behind, or gives added instruction to the brighter pupils who can make more rapid progress; another plan segregates pupils into groups, according to their ability, and permits each group to progress at a favorable rate; still another plan practically returns to the older method of individual instruction, abandoning class organization and permitting each pupil to advance as rapidly as he may.

On the whole, however, group-instruction, in spite of its disadvantages, has brought into school work a very important socializing influence. Children work together, learning from one another, competing with one another, sharpening one another's wits. And the more recent developments have been in the direction of still further organizing and utilizing these important social forces. It is the aim of modern education to make not only the school *studies* but also the school *life* of the pupils an important educative force. The school is to be looked upon as a miniature community, and the problems of this community are to be regarded as matters of deep concern to the pupils themselves. It is believed that by utilizing these opportunities a great deal may be done to cultivate in the pupils certain qualities which will make for social coöperation and which will do much to prepare them for the duties and responsibilities as well as for the privileges of citizenship.

Health and Physical Development. A third characteristic of modern education is its emphasis upon *health* and *physical* development. In the more progressive school systems, physicians, dentists and nurses are regularly employed to look after the health of the children. Careful physical examinations are made at stated intervals. Especial care is taken to detect and remedy physical defects that have been found frequently to be at the basis of mental backwardness—adenoids, enlarged tonsils, decaying teeth and defective hearing and eyesight. Some systems of schools also employ clinical psychologists who look after the health of the mind very much as the physicians, nurses and dentists look after the health of the body.

The modern school plant also includes abundant facilities for physical training and games. Ample playgrounds are especially important, and the expert supervision of the plays and games of children is now thought to be as essential as the provision of space and apparatus for play. The modern school plant also includes gymnasiums, swimming pools and shower-baths. Still another indication of the increased emphasis upon health is to be seen in the provision for school lunchrooms and "cafeterias."

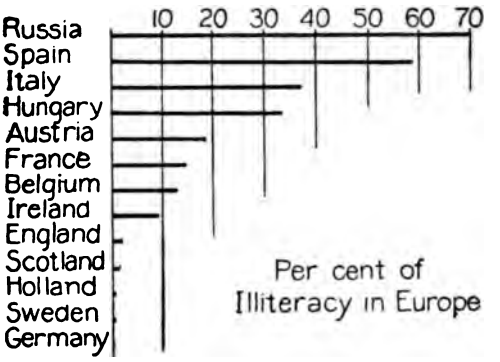
The Fundamental Arts. All of these and many more changes and improvements in the organization of education do not mean, however, that the modern school has neglected the work which the old-time school emphasized. The fundamental "arts" that made up the

curriculum of the elementary school a century ago—reading, writing and arithmetic—are no less important to-day than they have been in the past. It is probable, indeed, that they were never so important as they are to-day, and it is also probable that these basic subjects are being far more effectively taught in the modern school than they were in the schools of the past.

In so far as *school* education is concerned, indeed, these subjects will doubtless always have a fundamental place. And the reason is simple enough; when people live and work in close coöperation as they do under modern conditions, and as they must continue to do in increasing measure as civilization progresses, the arts of *communication* (the language arts) and the arts of *computation* (the simpler forms of which we call arithmetic) become of prime importance. Children readily learn to speak without the kind of training that the school provides; but few children can acquire a mastery of reading, writing and the essentials of arithmetic without careful instruction and training. Facility in these arts must be given, not merely to *some* children, but to *all* children; otherwise those who remained "unlettered" would be at a great disadvantage in life, so important are these arts under our complex social conditions.

Compulsory Education. During the past century, the principal countries of the world have made this basic or fundamental schooling compulsory upon all children between certain ages. Thus education is said to be "universal" in these countries, although it should be remembered that it is only this very elementary education in reading, writing and arithmetic (and usually in geography and the history of one's own country) that is really "universal." Notwithstanding this limitation, however, what this has come to mean to the lives of millions of people constitutes one of the great triumphs of modern civilization. "Universal" education, even in this limited sense, was practically unknown at the beginning of the nineteenth century. At that time, schooling of any sort was, generally speaking, the privilege of only a small proportion of the total population.

And there are, of course, many nations to-day that have done very little for the education of "all the children of all the people." How far a nation has carried the ideal of "universal education" is roughly measured by the per cent of illiterate adults in its total population. This per cent is lowest in the countries of Northern Europe (particularly in Germany, Holland, Switzerland and the Scandinavian countries); in the British Isles (and particularly in England and Scotland); in the Northern, Central, and Far-Western states of the American Union; in certain of the British possessions



These statistics are significant only in a general way, because of the different ways in which they are compiled. For Russia, Spain and France they represent the population over ten years of age unable to write; for Italy, those over ten unable to read; for Hungary, those over six unable to read and write; for Austria, those over eleven unable to write; for Belgium, those over ten unable to read or write; for Ireland, those over nine unable to read; for England and Scotland, marrying persons unable to write; for Sweden, army recruits unable to write, and for Germany recruits without schooling; Holland, recruits unable either to read or write.

(and particularly in Canada and New Zealand, but not in India); and in Japan. Another rough measure of the care which a nation exercises in matters educational is the per cent of its total population that is enrolled in its elementary schools, that is, in what corresponds to the first six, seven or eight years of our "common" schools. In a country where education is fairly general, the elementary schools at any one time will enroll between fourteen and twenty per cent of the total population. Thus England and Germany have each about seventeen per cent of the total population in these schools; the United States, about eighteen per cent; Canada, about fourteen per cent; Italy, only about nine per cent; Mexico (prior to the year 1913), about five per cent; Russia, less than three per cent.

Elementary and Secondary Education. "Elementary" education in the United States and Canada is usually thought of as covering the first eight years of the child's school life (the first eight "grades" of the common school). In general, elementary education in the two countries named comprises the particular kinds of knowledge and skill a mastery of which is believed to be essential to *all*. There is at the

present time a marked tendency to reduce the elementary school to a six-year basis, and to reorganize the seventh and eighth grades with the first year of the high school (the ninth grade) into what is called an "intermediate school," or a "junior high school." The chief advantage of this new organization is that it will permit a differentiation of school work at the beginning of the seventh year instead of at the beginning of the ninth year; the disadvantage lies in the fact that the earlier the school work is differentiated into distinct "curriculums" the less will be the total amount of work that all will have in common, and the more difficult will be the problem of making wise choices.

"Secondary education" is represented typically by the four high-school years. If the present plans for reorganization are generally accepted, however, secondary education will begin with the seventh grade. This type of education aims to meet somewhat specialized needs, and consequently attempts to provide more than one curriculum, or group, of studies. Thus in the larger high schools to-day one may find a rich variety of "curriculums." One curriculum may be made up largely of Latin, Greek, algebra, geometry, physics and other studies that have in the past been recognized as "preparing for college." Another curriculum may omit the classical languages, and provide instead a more extended training in English and in the modern foreign languages (especially German, French and Spanish).

Still another curriculum may aim to prepare boys and girls for business life, and will consequently emphasize such subjects as bookkeeping, stenography, typewriting, commercial law, commercial arithmetic and commercial geography. Another may be strongly "technical" in its purpose, and include not only "manual training" of the older type, but also thoroughgoing courses in draughting, machine-shop practice, foundry work and the like. Still another will have as its core the subjects that are related to the household arts—such subjects, for example, as chemistry, sanitation, textiles, home decoration, cooking and sewing. The essence of secondary education as it has developed in this country, then, is this provision of "differentiated curriculums" to meet different needs, tastes and occupational interests. The high school is no longer thought of as merely a school preparatory to college—a "fitting" school—but rather as a school preparing for a variety of life activities—a "finishing" school; but it should be added that preparing boys and girls for college is still an important task of the high school.

Higher Education. "Higher education" includes the work represented by the colleges and universities, or the years of school life from the eighteenth on. Like secondary education, it, too, is "differentiated" into separate curriculums, among which the old-time college course, with its rigid requirements of Latin, Greek and mathematics, is now scarcely recognizable.

Education of All the Children of All the People. But when we speak of "elementary," "secondary," and "higher" education as referring to conditions in the United States and Canada, we must remember that our educational situation is in many ways quite different from that which prevails in almost every other part of the civilized world. For example, in Germany, as in most of the European countries, there are different schools for different social classes, and the children of the "upper" and "middle" classes do not generally attend the same schools as do the children of the "masses." What in Germany corresponds to our elementary school (or the first eight grades) is called the "people's school," and is really a school for the masses. A boy or girl who passes through these eight years of schooling in Germany is not in a position to go on to anything corresponding to our high school and college. Indeed, boys and girls who are to go to college must be placed in a "secondary" school at about the age of nine (that is, at a point corresponding to our fourth grade). The result of this policy of separate schools is that secondary education and higher education are class privileges, practically limited to the children of wealthier parents who can afford to pay the tuition fees of the secondary school, and who can look forward to a higher education for their children.

What the United States and Canada have done in the organization of their schools, then, has been essentially to preserve the "open door" of opportunity for all. These schools are organized on a "unit" basis; someone indeed has characterized such a school system as an "educational ladder" with its "base in the gutter and its tip in the university." If at any point on this "ladder" the boy or the girl decides that he or she will have a higher education, the way is open; the steps will not have to be retraced as they must be in almost every other country if such a decision is reached after the

age of nine, ten or eleven years. This system also keeps the children of all classes together during the greater part of their elementary and secondary schooling; during the first eight years (or at least during the first six years, if the present proposals are generally accepted), these children are studying practically the same subjects, and to this extent the next generation will have a "common culture"; during the high school years some of the subjects are usually common to all of the pupils, and in any case the children are together in the same school and live the same school life. But in most of the European countries the children of the more favored classes are segregated from the children of the masses; their studies are different; there is no intermingling in a common school life; and there is little opportunity to make the school curriculums represent a basic common culture.

Whether or not the system these countries have developed really makes for democracy, it is certainly true that we keep together in our schools a larger proportion of boys and girls from all classes than does any other large country. There are to-day in the public high schools of the United States and Canada almost as many boys and girls as are enrolled in all schools of similar grade *in all other countries combined.*

Defects in Our Schools. But in certain respects, the schools of the two countries mentioned are not so efficient as are the schools of certain other countries. We do not provide the opportunities that Germany provides for specialized training for bread-winning occupations. Indeed, countries like Denmark, Norway and Switzerland probably lead us in what is called *vocational* education. There is a reason for this; in the European countries society is more clearly "stratified" than with us; one's social "station" is determined largely by birth, and there is little shifting from one level to another. In America, on the other hand, society is more "fluid," so to speak; there is much shifting from level to level; the child of the humblest citizen *may* reach the highest positions. Because of this democratic ideal, our school system has been slow to recognize the value of a narrowly-specified vocational training that would take the boy or the girl at a comparatively early age and train him or her toward a highly-specialized industrial efficiency. The slow development of vocational education, in other words, is due fundamentally to the fact that people do not like to think of anyone as "predestined" to a certain calling or occupation.

It is generally agreed, however, that present-day schools must in some way meet this need for *occupational training* which modern education in other countries has recognized and met. The present tendency is to establish vocational curriculums either in the high schools or in specialized vocational schools paralleling the high school. Students of education generally favor the former plan because it will not separate the children who go into trades from those who go into the professions, and it is believed that the longer the children of all classes can be kept together, the better it will be for democracy. The present judgment of educators is also strongly against attempting to "vocationalize" boys and girls prior to the end of the eighth school year.

Vocational and Continuation Education. Many attempts are being made to provide both general and vocational education for boys and girls who leave school and undertake bread-winning employment at the close of the compulsory-schooling period, which usually ends at the age of fourteen. In some cities, these boys and girls are provided for in "continuation schools," which take them from their employment for one or more half-days each week, and attempt to give them instruction that will help them in their work. In general, the problem of caring for these boys and girls who go no further than the compulsory-schooling laws require is recognized as one of the serious and perplexing problems of modern education. At the present time, the number of these boys and girls is probably three times as large as the number of those who go into the high school. These boys and girls go out into the industries between the ages of fourteen and sixteen—the period of life most seriously fraught with moral dangers. So heavy is the toll of wreckage from this large group who leave school early that these two years are sometimes called the "wasted years."

The situation is still further complicated by the fact that apprenticeship to reputable trades and professions cannot commonly be begun prior to the age of sixteen. The result is that most of the boys and girls who leave school prior to sixteen either go into "blind-alley" occupations that lead nowhere, or spend part of their time at "odd jobs" and the remainder in idleness and mischief. It is toward the solution of this problem that the present energies of education are being largely directed. W.C.B.

Hygiene of Education

By educational hygiene is meant those principles of health which apply to an individual during his period of education, and those which schools can promote through their various health agencies. The school period is one of growth and development, a period when moral and physical habits are formed, a *plastic* period when the young person is easily molded. Whether life is to be personally satisfactory and efficient, or unsatisfactory and inefficient, depends very largely on how these early years are spent.

Both physical and moral character tend to become fixed at a very youthful age. Changes after the age of early childhood are hard to bring about and require an amount of effort greater than that required in early life. Specialists in child study are realizing more and more that to a very large extent health, character and disposition are closely interdependent, and that early experiences count very much more than later ones. It is difficult to break down a good start in life, but it is more difficult to build up the results of an unfortunate beginning.

Educational hygiene deals with those simple but fundamental principles of health which affect daily living. It includes home environment, school environment, community environment, and personal health habits. It is a *formative* sort of hygiene and thus deals with the formation of right habits, rather than with the correction of wrong ones.

In order to form health habits intelligently one must have some understanding of the results of health neglect, must in some reasonable degree understand the meaning of health danger-signals, which are nearly always displayed, and finally must form habits of such a fixed nature that they become almost automatic, for the less we are obliged to think about health the better. Health is fundamental in life; health is the only real wealth; yet, as has been well said: "On every side, the world over, we are confronted by the fact that health, including normal physical development, longevity and good bodily resistance, is being only very inadequately achieved by millions of people."

Practically no one lives up to his highest possible degree of physical or intellectual efficiency or even approximates such a desirable result. Everywhere there is ruthless waste of [illegible] energy. The length of human life is less, by at least half, than what it might be; happiness is only a relative term, because happiness is conditioned largely by health, mental and physical. Personal efficiency is probably rarely over half of what it should be, and in many instances less than one-third.

Educational hygiene is to-day attempting to point out the way for the correction of these lamentable conditions, which after all are rather easily corrected when intelligently faced.

Physical Defects and Diseases of Children. For purposes of convenience, a distinction is made between *defects* and *diseases* as these terms are ordinarily used in respect to the various disorders of children. A defect usually means some disorder of growth and development quite apart from a sickness. For instance, adenoids obstruct breathing but do not directly cause disease. Near-sight is a defect and so is deafness, but neither is a disease, strictly speaking. The same may be said of improper postures, irregular teeth, nervous instability, stammering, stuttering and many other disorders.

Defects and true diseases do, however, shade into each other. Of course, medical inspectors in schools deal not only with defects of growth and development, but also with a good many actual diseases, such as colds, diphtheria, scarlet fever, tuberculosis and other contagious diseases. In the main, however, they are called upon to correct *defects*, which, if neglected, handicap a child and may easily lead to serious disease either during his child life or after he is grown.

Every person of any education should understand the nature of the common defects and diseases of child life, because of their importance in relation not only to a happy childhood, but also to an efficient sort of adult life.

Physicians are constantly learning more of the intimate relations existing between disorders of health in the child and disordered health in the adult. For example, until rather recently tuberculosis, when it occurred in an adult, was supposed to have developed perhaps from a neglected cold or something else which had reduced the general health of the individual. Now we know that in the great majority of all cases of tuberculosis in adults, the disease really dates back to an infection in childhood which has perhaps lain dormant for many years. In other words, if a child can be saved from this infection during his child life,

there is relatively little danger of this disease ever appearing in adult life.

The real problem of stamping out tuberculosis, that great plague which sweeps away about one out of every ten people the world over, consists in the prevention of infection with the germ of this disease during the years of childhood. This means a thorough understanding of those conditions necessary to a healthful life in childhood. It includes such things as clean milk, from properly-tested cows; a properly-adjusted diet for older children; an abundance of fresh outside air, night and day; proper clothing; the avoidance of personal contact with people sick with tuberculosis; early attention to adenoids and diseased tonsils; the proper care of the *first teeth;* and a few other of the essentials most often neglected.

The discovery and proper treatment of diseased tonsils in childhood go far toward the prevention of rheumatism and even one form of heart disease in adults. The prevention of ordinary colds in children will often save the adult from many serious disorders, such as catarrh, deafness, rheumatism and a general low state of resistance to many of the germ diseases. It is even probable that serious kidney disease and some diseases of the circulation which carry off so many people in middle life, just when they have become the most useful to the world, are often due directly or indirectly to some of the preventable disorders of child life.

Those diseases usually called "children's diseases," such as scarlet fever, measles, whooping cough and similar ones, contrary to the usual opinion of people, do greater harm in childhood than the same diseases would in adult life. They are *all* preventable.

Modern investigators in child study show us that a child's *mental character* is largely formed before he is seven years old, and perhaps even considerably younger than this age. Now, in the same way, modern investigators of child health are showing us that the child's *physical character* is also largely formed at this same early age.

Of course it is true that unfortunate mental traits are sometimes modified or entirely changed after the age of childhood, and it is equally true that weak physical conditions are sometimes offset by later influences, but this does not alter the rule, that in most important respects, the mental and physical nature of an individual is largely fixed at an early age in childhood. The old wise saying that "the child is father to the man" is proving to have a much greater significance than we originally supposed.

If these things are true, it is clear that young people as well as parents and teachers should understand their significance, for only by such knowledge can a safe, happy and thoroughly satisfactory life be expected. There is no doubt at all that if this modern health knowledge were general and put into practical effect, human life would be lengthened on the average at least twenty-five years.

The length of human life in highly civilized countries has already been greatly increased during the last one or two centuries, largely through decreasing infant mortality. Three hundred years ago the average length of life in Europe was only half of what it is to-day. In India, on the contrary, it has remained stationary.

Now the time has come to make use of our greatly enlarged knowledge of the human body and what affects it, to increase the length of life after *middle age,* as well as in infancy and childhood. Middle age (from 45 to 55) is a period of danger to the average person. This is the time when many incurable diseases seem suddenly to develop. With a wiser care of the child many of these disorders of middle life would never develop, for in childhood we now know that the seeds of later trouble are often planted.

Nature gives us many *danger signals* if we were but wise enough to recognize them. Many of these signals physicians have come to see and understand well. Most of them should be as easily read by other people as they are by the trained doctor, for there is no mystery about them, and no very unusual powers of observation are ordinarily required. Let us consider a few of the most important of these health danger signals.

Adenoids. A mouth-breathing child nearly always has an obstruction in the back of his nose called adenoids. He breathes with his mouth open for the simple reason that he cannot breathe any other way. The open mouth is nature's *danger signal.* Such children speak with a nasal voice, a voice of dull, dead quality, possessing no resonance. They often snore at night; usually they have many colds; earache and deafness are very common; nightmares are often caused by this obstruction to breathing; nearly all cases of crooked, prominent upper teeth are produced by adenoids,

adenoid children are often delicate, and prone to contract contagious diseases. No child can suffer long from adenoids without having his health seriously impaired, often for life.

A simple operation is the only cure for adenoids, and the time to have it done is *just as soon as they are discovered.*

Diseased Tonsils. Diseased tonsils are almost always found with adenoids, for tonsils and adenoids are composed of the same sort of tissue.

Frequent sore throat is a danger signal, and so are small white spots over the surface of the tonsils, even when the tonsils themselves are not sore. Healthy tonsils are small almond-shaped structures which are hardly visible in the throat. When they are enlarged so as to project into the throat from each side, they may usually be considered diseased and in need of removal. Diseased tonsils, large or small, have a close relation to rheumatism, heart disease, and to at least one nervous disease, chorea, or Saint Vitus's Dance.

It sometimes happens that tonsils which seem to give no trouble are the seat of chronic colds. In these cases the tonsils are what are called *cryptic,* and each little hole or crypt is an infected area from which germs spread to the nose and throat and set up a "cold." It is a wise thing for everybody who is subject to bad colds to have the nose and throat carefully examined by a specialist.

Defective Teeth. Probably no other one part of the body produces so much trouble as bad teeth do. Yet bad teeth are found in at least two-thirds of all school children. Some of the results of bad teeth are the following:

Indigestion.
Enlarged glands in the neck (kernels).
Poor state of nutrition.
Contagious diseases of several kinds (because germs find lodgment here).
A serious form of anaemia (deficient blood).
Headache.
Nervous disorders.
Fatigue.
Mental dullness.

The prevention of decay of the teeth is easier than the prevention of almost any other disorder in the body, yet the teeth receive perhaps the least attention. A repaired tooth is evidence of an earlier neglect.

If children's teeth from the very first received proper attention decay could be practically eliminated for a life time. Preventive dentistry is to-day the most important part of the dental profession. The common impression *that first teeth may* be neglected without much harm is strictly wrong. Sound first teeth are likely to assure sound second teeth.

The early loss of first teeth causes narrowing of the jaws (the jaws fail to develop), and often very crooked second teeth, for the reason that the jaws are too narrow to accommodate the second teeth. Not only this, but decay in a first tooth often spreads to the germ of the second tooth, and when this finally comes through the gums, it is already decayed. Decayed teeth, whether first or second, mean infected mouths.

A child should be taught to keep his teeth clean from the time he is three years old, and before this his parents should do it for him. After the first twenty teeth have come in, the child should visit a dentist twice a year at least for thorough cleaning and other preventive work. When this method is carefully followed, decay of the teeth with all the unpleasant consequences may be practically avoided.

The latest important discovery in dentistry is that very many roots of *dead teeth,* teeth in which the roots have been killed when the tooth was filled or crowned, afterward develop abscesses which may be entirely painless. Yet such accumulations of pus may be absorbed and cause very serious diseases in distant parts of the body. Only the X-ray will make certain whether or not such teeth have abscesses developing in their roots.

Orthodontia, or the art of straightening teeth, has been developed during the last ten years to such an extent that specialists can now straighten any teeth no matter how crooked, largely by a method of widening the jaws. Children with narrow jaws and crooked teeth should be treated as early as three years of age if necessary. It is much more difficult to straighten teeth as the child grows older.

Eye Defects. There are a good many danger signals of eye trouble in children which more often than not are unheeded. Of these the following are the most common:

Frequent headaches.
Crossed eye.
Red or painful eyes.
Peculiar postures while reading, such as holding head on one side.
Squinting or frowning.

If a child does not see words on the board clearly from his seat or if words in his books appear blurred or misty or crooked, there is nearly always some definite eye trouble. A good oculist should always be consulted when any trouble with the eyes is suspected. *Opticians* may fit glasses properly in simple un-

complicated cases, but it is always better to consult an eye specialist. The human eye is too important to take any chances with.

Neurasthenia, a nervous disease in adult life, is often caused by the neglect or mistreatment of eyes in childhood.

Nervous Disorders. Most of the nervous disorders of school children are of what are called the *functional* variety. Strictly speaking there is no such thing as a functional disorder, that is, everything has an organic origin if we were only able to find it, but the word "functional" is a convenient one to use, because it indicates a disorder for which we cannot discover the exact cause, and one which is not dangerous to life.

The common nervous troubles of children of the school age are as follows:

General nervous instability, and nervous exhaustion.
Habit spasms.
Saint Vitus's dance (chorea).
Morbid fears.
Night terrors.
Stammering and stuttering.
Epileptic fits.
Hysteria.

The two last named occur less often.

The child who is nervously *unstable* shows his disposition in ways which a teacher or a wise parent ought easily to understand. Such a child is likely to be very emotional at times, to laugh or cry easily; he has poor control of himself in general; often selfishness is a very prominent trait; concentration is usually poor, and while the child is often alert and bright, he is easily fatigued, and sometimes he is constantly fatigued. Such children are capricious in their habits, they are notional about their food, often sleep badly, and are usually below the normal weight. They seldom endure physical pain well, and in disposition are likely to be fault-finding and exacting.

It is from undisciplined children of this type that most of the neurasthenics or adult nervous people come. Sensible discipline and regular physical education are needed by these children if they are to succeed in life. Physical defects or actual diseases are sometimes at the root of the trouble.

Habit Spasms. By habit spasms are meant peculiar "tricks" or habits, such as twitching of the eyes, rolling the eyes, sniffing, grunting, coughing, jerking the head, shrugging the shoulders, and a great variety of other things which are done almost or quite unconsciously by the child. The condition always indicates a nervously unstable disposition, and calls for attention to the general physical state of the child. Special training will do good but *nagging* will do only harm.

Saint Vitus's Dance. Saint Vitus's dance is often confused with habit spasms, but is really a much more serious disorder. The muscular jerkings are usually distributed more widely over the body. The child drops things, kicks out his feet, stumbles, has spasms of the head, neck and shoulders. Often he is unjustly criticised for habits he can in no way control. In the majority of such cases trouble will be found with the *tonsils*. Rheumatism is often present, and the heart is very frequently affected.

Rest in bed, nourishing food, and attention to diseased tonsils cure many cases. Every case of Saint Vitus's dance requires prompt, careful medical attention.

Morbid Fears. Morbid fears are found in many nervous children when one knows how to search for them, but unfortunately they are often concealed by the sensitive child. Such fears include all sorts of things of simple or complicated nature. Sometimes these fears become fixed ideas which may haunt a child for months or years. Many of the nervous disorders of adult life are directly due to uncorrected morbid fears in childhood. Such repressed fears are often forgotten but are nevertheless still present in the subconscious mind. The greatest care should be observed to prevent such fears from becoming *fixed*. These fears may be connected with religion, with punishment, death, sickness, sounds, sights, stories, persons real or imaginary, and a great host of other things.

They often quite spoil the pleasure of living and thus render the child's life utterly miserable.

Night Terrors, Stammering and Stuttering. These are nearly always evidences of an unstable nervous organization and are danger signals which should always be heeded. Their indirect causes are many but may usually be discovered. Special training for those who have speech defects is usually necessary.

Epilepsy and hysteria are much more serious than any of the other nervous troubles mentioned, but fortunately they are also less frequently observed.

Epilepsy. Epilepsy, a disease whose typical symptom is spasms, is often indirectly caused by over-strain and digestive disturbances, but the direct cause is always due to a fundamental

defect in the nervous mechanism. Immediate attention is always demanded in every case.

Hysteria. Hysteria is mentioned only to caution against the use of this word in connection with nervous manifestations of uncontrol which are really not hysterical in nature at all. True hysteria is a serious disorder when it really is present. There are generally areas in the body which are unusually painful, and others which are quite sensitive to pain. Frequently the hysterical person falls, and seems to be quite unconscious.

Often there are strange contortions of the whole body and more or less paralysis may be present. Sometimes such an hysterical person will be unable to walk for weeks, months, or years. In many cases the imagination is very strongly affected—there may be actual hallucinations. Lying and other moral delinquencies may be observed in some cases. E.B.H.

Compulsory Education

By compulsory education is meant the right of society, acting through the state, to compel a certain amount of attendance at school. The modern government may support education, it may control and manage it, and it may enforce on an individual, on the theory that education strengthens the nation. In recent years it has become more and more common for a government not only to enforce a certain number of years of school attendance, but to insist, further, that the child who has completed the required number of years of study must also possess a certain amount of knowledge. If he fails to pass the examinations which are given to determine this he is not permitted to leave school. In general, the countries which have compulsory education require the attendance of all children between the ages of six and fourteen or six and sixteen years of age, for a certain number of months during each year, either in a public or in a private school. Laws compelling such attendance are in force in Great Britain, Germany, Switzerland, Norway, Sweden, Denmark and France, but in the other European countries, while such laws may be on the statute books, they are not rightly enforced. In the United States and Canada such laws exist and are in the main very well enforced.

Canada. Compulsory attendance laws have been passed by all the Canadian provinces except Quebec. Ontario has the most efficient system of public instruction in the Dominion, and its laws for compelling attendance have served as a model for the other provinces, the regulations in each case being modified by local conditions. In Ontario parents and guardians are compelled by law to secure the education of children in their care who are between the ages of eight and fourteen, either in private or in public schools. In connection with this regulation is a labor law which forbids the employment of children under four-

Vicious children and those who refuse to submit to discipline must be placed in industrial schools. Every city, town and incorporated village must have one or more truant officers, and these officials are given ample authority to investigate all cases of truancy. Throughout Canada compulsory laws are enforced much more carefully in the cities than in the rural districts.

The United States. Compulsory education in the United States was first enforced in Massachusetts Colony in 1642, but the state did not require such attendance until 1852, and the first really satisfactory law was enacted in 1872. In 1878 it was provided that state grants of money could be withheld from towns which did not enforce the truancy laws. The present law prohibits the employment of children during the hours of school session and requires the presentation of a certificate issued by the school authorities in the case of employment of children under sixteen.

Connecticut had an early history similar to that of Massachusetts, but in 1872 a bill was passed which has probably given that state the best compulsory system possessed by any state. In Connecticut both the child labor laws and the compulsory education laws are in the hands of state agents, and are very rigidly enforced. The District of Columbia passed compulsory attendance laws in 1864; Vermont in 1867; New Hampshire, Michigan and Washington, 1871; New Mexico, 1872; Nevada, 1873; New York, Kansas and California, 1874; Maine and New Jersey, 1875; Wyoming, 1876; Ohio, 1877; Wisconsin, 1878; Rhode Island, Illinois, Dakota and Montana, 1883.

In about one-third of the states free books are furnished by law to those whose parents are too poor to provide them. In two states, Colorado and Ohio, local authorities are authorized to furnish free clothing for those children who have to stay away from school because they are not properly dressed. Compulsory

"When a Feller Needs a Friend"

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attendance laws have been particularly necessary because of the tendency to employ children in mines, factories and large stores and to exploit them at home. In large cities it is comparatively easy to enforce the laws, but in the country and in smaller towns it is often very difficult. Probably some of the worst examples of child exploitation may be found on farms.

Compulsory attendance laws are enforced by truant officers who are appointed by the local boards of education. These officers usually have the authority to arrest and commit to school any child to whom the law applies. If, after warning, the parents do not keep their children in school, the officer has authority to arrest the parents and bring them before the local court for trial.

Within the last few years it has become plain that three or four different types of school are necessary in any city which is determined to carry out the compulsory attendance law. There must be special institutions for those pupils who have become incorrigible and whose parents have lost control of them, because the attendance of such children in the ordinary school is harmful to the other pupils. A modification of such an institution, in the form of a day school which would add to the ordinary school course enough interesting play and work to keep the child busy all day and prevent his being on the streets, could take care

of semi-incorrigibles. Such a school would permit its pupils to go home at night. English cities provide such schools, but there are none in America. Special classes must be provided for backward children and for exceptional children. Morons (feeble-minded children or children who are physically or mentally abnormal) are usually sent to special institutions. The republic is on the way to realize the sort of specialization that will take care of every individual child in the best possible way, but there is still much to be desired. However, the child is rapidly coming into its own. See SCHOOLS. A.C.

Educational Museums

Visual instruction has become an important educational factor in the schools. The use of concrete materials, of objects and pictures, of the lantern slide, stereoscope and moving pictures as a supplement to the text-book and the teacher's description of facts and conditions, have found their way into many schools.

Efficient help in this direction has come from the museums. They have opened their great storehouses of information to the schools, and they ask the teachers to make extensive use of the wonderful things gathered from all parts of the world. Some of the museums send typical loan collections of museum material, mounted specimens of the animal world and soil and industrial products to the schools. Others invite the teachers to bring their classes to the museum and to give their lessons there, aided by the wealth of interesting specimens which are placed at their command. Still others arrange courses of lectures on certain topics of the school curriculum for pupils. Some of the institutions coöperate with the schools through two or all three of these activities.

The museums which make their illustrative material accessible to the schools may be divided into four classes:

(a) Public museums of science.
(b) Children's museums.
(c) School museums.
(d) Art museums.

The Public Museums. A brief description of the effectiveness of the assistance given public school work by some of the leading museums is given below. The information on public museums and children's museums is derived from a series of articles on *Educational Work in American Museums*, published in the reports of the Commissioner of Education of the United States (1913-1915), and prepared by Paul M. Rea:

The American Museum of Natural History. This museum, located in New York City, has a department specially assigned to coöperation with the schools of New York. It has 635 traveling *ibits, comprising* more than 10,000 specimens which are in daily use in 400 schools having more than a million pupils. Lectures on geography, history and science are given every year at the museum to 40,000 or 50,000 children. Thirty thousand lantern slides, accompanied by full descriptions, are sent to the schools for use in the classroom.

The Commercial Museum in Philadelphia supplies the schools of the city and the state with large cases containing about 400 objects and 100 photographs which illustrate the peoples and products of the world and are accompanied by all necessary information and instructions. These cases become the property of the schools.

Fifteen lanterns and collections of slides are circulated in the various parts of Pennsylvania. Free lectures are given in the museum to classes of the schools. The Commercial Museum, which through its foreign trade bureau acquires valuable information and material as to commerce and industry, extends its educational work into all parts of Pennsylvania.

The Public Museum of Milwaukee. This museum loans collections of birds, small mammals, insects, Wisconsin archaeology, geology and commercial products to the schools, and such collections are extensively used. All public school children of the four higher grades of the Milwaukee schools go to the museum twice a year for a half-day visit to hear illustrated talks on some subject closely related to their class work. Lecture courses are arranged for the general public, teachers and students of normal, vocational and high schools. The museum has a special department of education, in charge of a curator.

The Charleston Museum. The Charleston (S. C.) Museum maintains a department of public instruction in charge of a curator, who arranges the work of the department with the board of school commissioners. Over seventy traveling exhibits are in regular use in the schools and are delivered by a wagon provided by the museum. Other opportunities offered to the schools are lectures on particular exhibits; special lectures at the museum to illustrate school subjects; special exhibits of educational value presented from time to time; lectures to primary teachers on nature study; the use of a room and specimens for teachers with classes.

The Buffalo Society of Natural Sciences. This was one of the first to institute a department for coöperation with the schools. Traveling exhibits are sent to the schools, and classes of the elementary schools of the city come to the museum for regular lectures and demonstrations, which are an official part of the school curriculum. Free lectures are given to the public one evening each week, from November to May.

The Fairbanks Museum of Natural Science. This institution is located at Saint Johnsbury, Vt. It gives nature lessons to classes of the public schools, in coöperation with the superintendent of schools. The pupils of the city schools from the third to the ninth grade have regular monthly lessons at the museum.

The Museum of Natural History. This museum, at Springfield, Mass., loans to the schools. Teachers with their classes go to the museum to give instruction in certain subjects, for which a classroom and illustrative material are provided.

The Park Museum. School children in groups of fifty to one hundred visit this institution, located in Providence, R. I., to receive instruction with the aid of the illustrative material in the museum.

The Cincinnati Society of Natural History. This museum circulates school cabinets containing collections of birds, insects and minerals, accompanied by explanatory literature. Illustrated lectures are given to the general public one evening each week.

The Chicago Academy of Sciences. Classes of the city schools are invited to study in the museum a large series of *habitat* area and the celestial sphere, a mechanical device for the study of heavenly bodies. A children's science library and story hour conducted by the librarian are among other opportunities afforded the children.

The Newark Museum Association. This museum, at Newark, N. J., loans to the schools rocks, birds, butterflies, physiographic models and industrial collections. Its library circulates in the schools books, magazines, newspaper cuttings, pictures, charts, etc. Each year the museum has a special exhibit covering some human industry, which is shown and explained to school classes.

The Public Museum of the Staten Island Association of Arts and Sciences offers illustrated talks on school subjects to children above the fourth grade on Friday afternoons from October to April.

The California Academy of Sciences, San Francisco, began planning in 1916 the circulation of natural history cabinets in the city schools.

The Oakland Public Museum, Oakland, California, sends to the schools a series of loan collections. An excellent exhibit of American colonial material is made the basis of lectures to school children and teachers. Other lectures on history and nature, closely correlated with the course of study in the public schools, are also provided.

The Museum of History, Science and Art, Los Angeles, California, is organizing a system of educational work for the public schools modeled after that of the Milwaukee public schools.

The Academy of Sciences, Davenport, Iowa, conducts nature classes in the museum, provides for lectures to teachers and neighborhood groups and for a series of "museum talks" on Sunday afternoon. Field trips for pupils of the schools are undertaken in the spring. There is no formal coöperation with the schools.

Children's Museums. *The Children's Museum* of Brooklyn, N. Y., a branch of the Central Museum of the Brooklyn Institute of Arts and Sciences, was the first museum organized solely for children in the United States. Its object is—

To form an attractive resort for children with influences tending to refine their tastes and elevate their interests.

To create an attractive educational center for daily assistance to pupils and teachers in connection with school work, and to offer new subjects of thought for pursuit in leisure hours.

The scope of work of the museum is the preparation of collections which the children can enjoy, understand and use; an arrangement of material pleasing to the eye and expressive of a fundamental truth; briefly descriptive labels expressed in simple language; a system of instruction which children will voluntarily employ. The museum building has twelve exhibition rooms, a lecture hall and a library. In the exhibit rooms are collections of natural history, geography, United States history and art. The institution is very popular, and the average attendance is more than 100,000 children a year. While there are no official relations between the museum and the public school, the exhibits are correlated as far as practicable with the public school work, and lectures supplementing the courses of study are regularly given during the year.

The Children's Museum, Boston, Mass., was opened in 1913 in response to the desire of a group of teachers for some adequate assistance in presenting the subject of nature study to their classes. The material at the service of the children consists of exhibits illustrating various departments of natural history, ethnology and industry, flower tables, etc. Three hundred lectures are given a year, and the average daily attendance of children is upward of 200.

The Children's Museum of the United States National Museum. The United States National Museum maintains a museum for the children of Washington "for the benefit of very young people, their entertainment, rather than instruction, as an attractive means of inculcating a love of nature." The exhibit comprises familiar American birds; common European birds, interesting water birds, curious birds, such as the crocodile bird, etc.; brilliantly-colored birds, curious nests and eggs; specimens, with accessories, representing protective mimicry; remarkable insects; bright-colored shells; other interesting invertebrates; remarkable minerals.

School Museums Proper. Among museums of this class the following may be noted:

The N. W. Harris Public School Extension of the Field Museum of Natural History in Chicago. In 1911 Mr. Norman W. Harris of Chicago gave the Field Museum an endowment of $250,000, the income from which is to maintain a special museum for the use of the public schools of Chicago. The new school museum opened its

doors in 1913. It is a traveling museum which sends cases of zoölogical, botanical and geological material to the schools. Economic collections which are useful in the study of geography and commerce for the illustration of production and distribution form part of the material in circulation. The cases present small animals, birds, fishes, plants, minerals, etc., in lifelike imitation of their natural surroundings. They are delivered at the schools by an automobile, remain for two weeks and are then replaced by others.

The Educational Museum of the Saint Louis Public Schools is the only museum in the United States which is a regular part of the school system. It is a traveling museum. The material, consisting of 2,000 individual and 8,000 duplicate collections for circulation, is grouped and arranged in accordance with the course of study, and is used in direct connection with the school work. Each school has a delivery day once a week. The principal orders the material that is to be used in his school for the illustration of classwork during one week, and two days later the museum automobile truck delivers the material and takes back what had been used during the previous week. Each teacher has a catalogue.

The groups of material are food products, materials for clothing, other natural products, industrial products; the animal world; plants, and models and charts of plants, minerals, rocks and ores; articles and models illustrating the life and occupations of the different peoples of the world; apparatus for the illustration of physics and physical geography; charts, photographs, maps and objects illustrating history; charts and objects illustrating physiology; literary and musical records for the school phonographs; and photographs, stereoscopic views and lantern slides to accompany the preceding groups. During the year 1915 over 70,000 collections were sent to the schools.

A teachers' library of 10,000 volumes, consisting of books on philosophy, psychology, education, school management, text-books used in the United States and other countries, reports and courses of study from all parts of the world and reference books on everything the museum contains, furnishes books to the teachers by the museum automobile. Nearly 4,200 books were in circulation in 1915.

A study exhibit, which gives the teachers of the city the opportunity to make themselves familiar with the different types of material for circulation in the schools, is placed in two large adjoining rooms of the museum building. In glass cases there are exhibited in the order of the catalogue one or two types of each of the 2,000 individual collections, the whole display constituting an open catalogue. Reference books, the titles of which are given at the head of each group in the catalogue, are at the teachers' service. All the students of the Harris Teachers College—Saint Louis employs only graduates of this institution in its elementary schools—receive a thorough training in the use of the material. In the winter and summer extension classes of the college courses in the use of illustrative material are also given.

The United States National Museum is not in a position to conduct any of the usual forms of extension work, but has coöperated with the schools in a very efficient and successful way by distributing among schools and colleges valuable material for the illustration of school work.

Art Museums. The following art museums in the United States have established a system of coöperation with the schools of the cities in which they are located:

The Museum of Fine Arts, Boston.
The Worcester, Mass., Art Museum.
The Rhode Island School of Design, Providence.
The Parrish Art Museum, Southampton, L. I.
The Arnot Art Gallery, Elmira, N. Y.
The Albright Art Gallery, Buffalo, N. Y.
The Carnegie Institute, Department of Fine Arts, Pittsburgh, Pa.
The Minneapolis Institute of Arts.
The City Art Museum, Saint Louis, Mo.
The Western Gallery of Art, Kansas City, Mo.
The Toledo Museum of Art.

J.W.W.

Canadian Museums. Strictly speaking, there are no educational museums in Canada. There is a museum in connection with the Department of Education in Toronto, which issues an archaeological report, relating particularly to archaeology in Ontario. In the same city is the Royal Ontario Museum, partly operated by the Ontario government and partly by the University of Toronto, which covers everything from fine arts to mining.

In Ottawa, connected with various departments of the Federal government, are museums, and there are a few small collections connected with various historical societies throughout the Dominion, especially in the Province of Ontario. The largest collection of Canadian prints, so far as known, is in the museum of historical pictures relating to Canada, in the Public Library in Toronto; this is known as the John Ross Robertson collection. G.H.L.

National Education Association

This name is applied to a society of teachers and educators of the United States, organized at Philadelphia, in 1857, as the National Teachers' Association, and incorporated under its present name in the District of Columbia in [illegible]. A number of similar but smaller associations were founded early in the nineteenth century. One of the best known, the American Institute of Instruction, organized in 1830, covered New England; another was organized in Ohio, and still another in Philadelphia. In 1856 the presidents of twelve of the state asso-

ciations sent out a call for a general association to "advance the dignity, respectability and usefulness" of the teaching profession and the science of education, "by distributing among all the accumulated experience of all."

With so general an aim the association grew but slowly, and it was not until 1870, when it began to divide into departments and to specialize, that growth became rapid. This specialization made the organization much less unwieldy and increased its usefulness. The association includes the National Council, an advisory body of 120 members, the Department of Superintendents, and eighteen other departments, covering practically every phase of educational work. Excepting those of the Department of Superintendents, the annual meetings of these departments occur at the time of the annual meeting of the association, which is usually held the first week in July. The Department of Superintendents includes in its membership all the leading educators of the country. It holds its regular meeting the last week in February or the first week in March, and most of the other departments hold special meetings at the same time and place.

An *Annual Report*, a comprehensive account of the work accomplished, is also issued. This report records some of the most important educational advances and discoveries which are being made. Some of the reports which have promoted much discussion and have had far-reaching effects are an investigation and report on the secondary school course (1892); on elementary schools (1895); on rural schools (1897); on college entrance requirements (1899); and on teachers' salaries (1913 and 1914).

There are about 10,000 active members of the association, but a great many more than that number attend the annual July meetings, for the larger proportion consists of associate members, who are permitted to attend meetings but may not hold office. A.C.

Education for the Home

The difficulties and trials of wives and mothers in remote rural districts, far from post office, school or library, for years have been the special problem of the United States Bureau of Education. Pathetic appeals for help in the care and education of their children, sent by thousands of women throughout the country, have brought vividly before the officials of the Bureau the need for a special department to take care of these isolated mothers. Accordingly, a home-education division has been organized in the Bureau. The objects of this branch of the work are stated as follows in a recent bulletin:

> To help parents in the home education of their children with reference to health, games and play, early mental development and formation of moral habits; to interest boys and girls who have left school and are still at home, by directing their home reading and study, and to further the education of the parents in the home.

In the hope of reaching as many homes as possible, the Bureau coöperates with the National Congress of Mothers and Parent-Teacher Associations (which see). County superintendents were asked to furnish names of women in their communities on whom the Bureau could rely for aid in securing mailing lists; in this way, and through other channels, the Bureau obtained the names of about 40,000 women who desired help in the care and home training of children. This number will, of course, be constantly increased. Assistance is given through the medium of helpful bulletins on "home matters"—for example, material for home study, literature on moral training, plans for reading courses and suggestions for organizing sewing and cooking classes and parent-teacher associations. In some states efforts are being made to reach isolated people by means of traveling libraries and similar agencies, but these do not usually meet the needs of mothers who are trying to train their children according to sound principles of development. To these women the home-education division is a timely and special aid, and with their help must become valuable. See PARENT-TEACHER ASSOCIATIONS. See subtitle below, *United States Bureau of Education*. B.M.W.

United States Bureau of Education

This Bureau in the Interior Department was created by Congress in 1868 to gather and distribute information on education. Owing to the strong objection by Congress and the states to any interference with the state educational systems by the national government, the work of the Bureau has always been of an advisory nature. The chief officer has the title of Com-

missioner of Education, and is appointed by the President with the consent of the Senate. For several years there has been an endeavor strongly supported by educators to raise the Bureau of Education to the rank of an executive department of the government, in which event the Commissioner of Education would become a member of the President's Cabinet with the rank of Secretary.

The Bureau is organized into a number of divisions, the most important of which are those of school sanitation and hygiene, higher education, school administration, rural education, and the editorial and library division. The Bureau is engaged in collecting and distributing information bearing upon educational matters, and in giving assistance to any state or locality along educational lines, when such assistance is desired. The annual *Reports* of the Commissioner to Congress are among the most important records of American education. *Circulars of Information* and *Bulletins* are also published. These may be obtained by any one interested in education by asking for them. Specialists are employed in each of the divisions, who attend educational conventions, carry on investigations and deliver lectures whenever they are called upon to do so. The Bureau is sustained by appropriations made by Congress, but the appropriations are not sufficient to enable the Bureau adequately to meet the demands of the country. The first Commissioner, appointed in 1867, was Henry Barnard, who served three years. His successors, with their terms of service, are as follows: John Eaton, 1870-1886; Nathaniel H. R. Dawson, 1886-1889; William T. Harris, 1889-1906; Elmer E. Brown, 1906-1911; Philander P. Claxton, since 1911. W.F.R.

Consult Monroe's *Cyclopaedia of Education;* Butler's *The Meaning of Education;* Dewey's *The School and Society;* Hughes' *Mistakes in Teaching;* Compayré's *History of Pedagogy;* Monroe's *History of Education,* and the *Reports of the United States Commissioner of Education.*

Related Subjects. The more general phases of the subject of education are treated under the subtitles in the above article, but many special topics are given separate treatment in these volumes. The following articles have a close connection with the subject. Many of these in turn have lists of related topics, so that the reader is given a very wide range.

GENERAL

Abacus
[illegible]emy
[illegible]ence
[illegible]ture
[illegible]Mater
Blind, Education of the
Business College
Child
Child Study
Coeducation
College
Conservatory
Corporal Punishment
Correlation
Deaf and Dumb
Deductive Method
Drawing
Elective Studies
Extension Teaching
Feeble-minded, Education of
Fellowship
Games and Plays
Gardening
Gary School System
Gymnasium
Household Arts in Education
Indians, American, subhead *Indian Education*
Industrial School
Intelligence, The Measurement of
Kindergarten
Law Schools
Lyceum
Medical Schools
Mental Handicaps
Methods of Teaching
Montessori Method
Motivation of Teaching
Negro
Normal School
Parent-Teacher Associations
Peabody Educational Fund
Pedagogics
Rhodes Scholarships
School Garden
Schools (with numerous subheads)
Slater Fund
Sloyd
Story Telling
Teachers' Institute
Technical and Industrial Education
University
University Extension
Visual Instruction
Vocational Training
Wrangler

IMPORTANT SCHOOL SUBJECTS

Algebra
Anatomy
Archaeology
Arithmetic
Astronomy
Botany
Calculus
Chemistry
Civil Government
Geography
Geology
Geometry
Grammar
Industrial Art
Language
Literature
Manual Training
Mathematics
Mechanical Drawing
Mineralogy
Natural History
Nature Study
Penmanship
Philology
Philosophy
Phonetics
Physical Culture
Physics
Physiology
Psychology
Reading
Rhetoric
Sanitary Science
Shorthand
Sociology
Spelling
Trigonometry
Writing
Zoölogy

EDUCATIONAL INSTITUTIONS

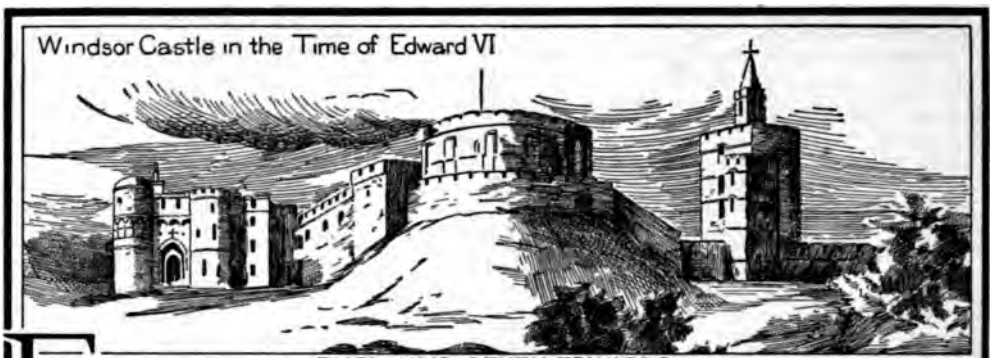
Acadia University
Alabama, University of
Alberta, University of
American University
Amherst College
Arizona, University of
Arkansas, University of
Armour Institute of Technology
Barnard College
Berea College
Berlin, University of
Boston University
Bowdoin College
British Columbia, University of
Bryn Mawr College
California, University of
Cambridge, University of
Carnegie Foundation
Carnegie Institution
Catholic University of America
Chautauqua Institution
Chicago, University of
Cincinnati, University of
Clark University
Colorado, University of
Columbia University
Cornell University
Dalhousie University
Dartmouth College
Denver, University of
De Pauw University
Drexel Institute

Edinburgh, University of (subhead under EDINBURGH)
Eton College
Fisk University
Florida, University of
Georgetown University
George Washington University
Georgia, University of
Girard College
Hampton Normal and Agricultural Institute
Harvard University
Idaho, University of
Illinois, University of
Indiana University
Iowa, University of
Iowa State College of Agriculture and Mechanic Arts
Johns Hopkins University
Kansas, University of
Kentucky University
Knox College
Laval University
Leland Stanford Junior University
Lick Observatory
Louisiana State University
McGill College and University
Maine, University of
Massachusetts Institute of Technology
Michigan, University of
Minnesota, University of
Mississippi, University of
Missouri, University of
Montana, University of
Mount Allison University
Nebraska, University of
Nevada State University
New Mexico, University of
New York, College of the City of
New York, University of the State of
New York University
North Carolina College of Agriculture and Mechanic Arts
North Carolina, University of
North Dakota, University of
Northwestern University
Notre Dame, University of
Oberlin College
Ohio State University
Oklahoma, University of
Oregon, University of
Oxford University
Paris, University of
Pennsylvania, University of
Princeton University
Purdue University
Queen's University
Radcliffe College
Rugby School
Saskatchewan, University of
Smith College
South Carolina, University of
South Dakota, University of
Syracuse University
Tennessee, University of
Texas, University of
Toronto, University of
Tufts College
Tulane University of Louisiana
Tuskegee Normal and Industrial Institute
United States Indian Industrial and Training School
Utah, University of
Valparaiso, University of
Vanderbilt University
Vassar College
Vermont, University of
Virginia, University of
Washington, University of
Washington and Lee University
Washington University
Wellesley College
Western Reserve University
West Virginia, University of
William and Mary College
Williams College
Wisconsin, University of
Wyoming, University of
Yale University

EDUCATORS

Adams, Charles Kendall
Adams, Frank Dawson
Alderman, Edwin A.
Andrews, Elisha Benjamin
Angell, James Burrill
Armstrong, Samuel Chapman
Arnold, Thomas
Barnard, Frederick A. P.
Barnard, Henry
Brown, Elmer Ellsworth
Bryce, George
Burwash, Nathanael
Butler, Nicholas Murray
Calder, James Alexander
Cameron, Agnes Dean
Carman, Albert
Claxton, Philander P.
Coleman, Arthur P.
Comenius, John Amos
Dawson, Sir John William
De Mille, James
Dewey, John
Draper, Andrew Sloan
Duncan, Norman
Eliot, Charles William
Fenelon, François de Salignac
Froebel, Friedrich Wilhelm August
Garfield, Harry Augustus (subhead under GARFIELD)
Gilman, Daniel Coit
Grant, George Monro
Hadley, Arthur Twining
Hall, G. Stanley
Harper, William Rainey
Harris, William Torrey
Hibben, John G.
Hopkins, Mark
Hughes, James Laughlin
James, Edmund Janes
Jordan, David Starr
Judson, Harry Pratt
Low, Seth
Lowell, Abbott Lawrence
Lowell, James Russell
Lyon, Mary
Mann, Horace
Mather, Increase
Montessori, Maria
Northrop, Cyrus
Norton, Charles Eliot
Page, David Perkins
Palmer, Alice Freeman
Parker, Francis Wayland
Pestalozzi, Johann Heinrich
Ryerson, Egerton
Schurman, Jacob Gould
Shaeffer, Nathan C.
Stoner, Winifred Sackville
Sturm, John
Swett, John
Tyler, Moses Coit
Van Hise, Charles Richard
Vincent, George Edgar
Washington, Booker T.
Wheeler, Benjamin Ide
White, Andrew Dickson
White, Emerson
Willard, Emma Hart
Wilson, Woodrow
Woolsey, Theodore Dwight
Yale, Elihu
Young, Ella Flagg

EDUCATION, COMMERCIAL. As in so many other educational movements, Germany was the pioneer in the field of commercial education, and even before the beginning of the nineteenth century provided business instruction in some of its schools. Not until about the middle of the nineteenth century, however, did the United States awaken to the value of such work. The first commercial schools were private enterprises (see BUSINESS COLLEGE), but the states soon saw the necessity for providing for such pupils as could not afford to pay tuition, as well as for such as desired a less strictly commercial course than was given by the business colleges. The result was the introduction of business courses into many of the public high schools. At first these attracted comparatively few pupils, but as it became apparent that the courses offered were as thorough as those given in most business colleges, they became very popular.



ENGLAND'S SEVEN EDWARDS

EDWARD, a royal name in English history, borne by seven monarchs since England became a united nation through the conquest of William I, in 1066. The first was named for Edward the Confessor, who ruled Anglo-Saxon England in the eleventh century. Of the seven Edwards, Edward VII is the most notable, because of his influence on twentieth-century life.

Edward I (1239-1307), whose fame as a law-giver has won him the title the "English Justinian," succeeded his father, Henry III, in 1272. The news of the latter's death reached him on his way home from the Crusades undertaken by Louis IX of France, and he was not crowned until 1274. Shortly after his return to England he began war on the Welsh, whom he subdued after a struggle that lasted nearly ten years. In 1282 Wales became a part of the English realm, and Edward made his little son feudal lord of the Welsh, with the title of Prince of Wales.

The greater part of his reign was given over to the attainment of his great ambition, the possession of Scotland. In 1290 there were several claimants to the Scottish throne, chief of whom were Robert Bruce and John Baliol. Edward, asked to decide between them, chose Baliol, but on condition that he pay homage to the English king as his superior.

The brave Scottish people, humiliated by this condition, rose in arms, and in 1306, after a long struggle of varying fortunes, Robert Bruce, grandson of Baliol's rival, was crowned at Scone. Edward sent an English army to Scotland to subdue the new king, and soon after set out himself for the north, but died within "sight of the country which he had devoted to destruction" (Hailes). During the war he carried off to London the great Stone *Scone, upon which* the Scottish kings had been crowned for centuries. This famous stone now rests beneath the seat of the coronation throne of the English monarchs in Westminster Abbey.

In home affairs Edward was one of the greatest kings of his time. He established order in England, improved the law and made regular the representation of the Commons in Parliament. One of his most important decrees was that the right of levying taxes rested with Parliament.

Edward II (1284-1327), the first English monarch to bear, as son of the king, the title Prince of Wales, succeeded his father Edward I in 1307. He was a weak and incompetent ruler, constantly under the influence of unscrupulous favorites, which led to rebellions on the part of his nobles. The war begun by his father against the Scotch was continued by this king, but with ill success, and Scottish independence was assured in 1314, by the great victory at Bannockburn. Edward invaded Scotland again in 1322 but he was forced to conclude a truce of thirteen years and to return to England. Finally, he was deposed by a conspiracy of his wife and the great nobles of the kingdom, and in 1327 was murdered in Berkeley Castle.

Edward III (1312-1377), son and successor of Edward II, was the king in whose reign the memorable Hundred Years' War with France began. Before he commenced the struggle with the French he invaded Scotland and laid that country waste, winning a number of victories that were only of temporary importance. He could not crush the Scotch spirit of independence.

Edward brought on the war with France by laying claim to the French crown, and in 1346 won the first great combat of the struggle, the famous Battle of Crécy. In this battle he was assisted by his son, the Black Prince, a cour-

ageous lad of sixteen. Calais fell to the king's army after a year's siege, and in 1356 the Black Prince inflicted a terrible defeat on the French at Poitiers, capturing their king. Later, the English were less successful, and in 1375 Edward withdrew from the struggle because his country was exhausted. During the last years of his reign he quarreled constantly with Parliament, the members of which were aided in their opposition by the Black Prince.

Edward IV (1442-1483) came to the throne in 1461, when the rival houses of York and Lancaster were engaged in the Wars of the Roses. Edward's father, Richard, Duke of York, was the grandson of the fourth son of Edward III, the rival line of Lancaster being descended from John of Gaunt, the third son. In 1460 Richard was defeated and slain at the Battle of Wakefield, and Edward, placing himself at the head of the Yorkist party, led his forces to victory at Towton Field (March, 1461) and won the crown from the helpless Henry VI.

His hold on the throne was not secure, however, and when in 1469 the powerful Earl of Warwick went over to the side of the Lancastrians Edward was forced to flee from England. Two years later he returned, gathered together an army and reëstablished his claim to the kingship by the decisive victories of Barnet and Tewkesbury. The remainder of his reign was peaceful and was marked by his policy of strengthening the royal power. In this manner he paved the way for the absolute monarchy under the Tudors. During Edward's reign printing and silk manufactures were introduced into England.

Edward V (1470-1483) succeeded his father, Edward IV, at the age of thirteen. Richard, Duke of Gloucester, the cruel and unscrupulous uncle of the young king, at once proclaimed himself Protector of the Kingdom, and sent Edward and his younger brother prisoners to the Tower of London. There they were smothered to death by one of Richard's nobles, and the Duke became king as Richard III. The pathetic story of the murdered princes is given poetic treatment in Shakespeare's *King Richard III.*

Edward VI (1537-1553), the son of Henry VIII by his third wife, Jane Seymour, succeeded his father in 1547. Edward was one of the boy kings of England, for he was only ten when he came to the throne, and he died at the age of sixteen. During the greater part of his reign the affairs of the kingdom were in the control of the king's uncle, Edward Seymour, Duke of Somerset. During this period Protestantism was established as the state religion. In 1549 the *English Book of Common Prayer* was prepared by Archbishop Cranmer, and in 1552 the famous Articles of Religion were published.

Edward VII (1841-1910), whose title in full was "King of the United Kingdom of Great Britain and Ireland, and of all the British Dominions beyond the Seas, Emperor of India," was the eldest son of Queen Victoria and

ALBERT EDWARD (EDWARD VII)
Son of Queen Victoria and father of George V.

the Prince Consort, Albert. He was born in Buckingham Palace on November 9, 1841, was christened Albert Edward, and by right of inheritance received the title Prince of Wales at his birth. The Prince was educated in a manner befitting the heir apparent to the British throne, and among his early tutors was the novelist, Charles Kingsley. His university training consisted of a session at the University of Edinburgh, a year at Christ Church, Oxford, and four terms at Cambridge. In 1860 he visited Canada and the United States, where he was most cordially welcomed, and two years later, in company with Dean Stanley, traveled through Egypt, Palestine and India.

In 1863, then twenty-one years of age, Prince Albert Edward took his seat in the House of Lords, formally beginning his public life. The same year he married Princess Alexandra, eldest daughter of Christian X of Denmark, who came to be greatly loved by the English peo-

EGG. There is an old question which in times gone by wise men did not scorn to puzzle their brains about, and which even today is occasionally propounded just to cause confusion—"Which came first, the hen or the egg?" It is a question which admits of no answer, for each is absolutely essential to the existence of the other. In all ranks of life above the very lowest, where reproduction takes place by simple division, it is impossible for young animals to be produced except from eggs. In the highest of all classes, the mammals (which see), it takes the egg a long time to develop, and it remains in the body of the female until it is hatched. Even then the young animal is not brought forth at once, but is sheltered within the body of the mother until it has partially matured.

But in far more numerous cases animals lay their eggs to be hatched later, and it is eggs of this sort which are ordinarily meant when the term is used. Worms, mollusks, insects, fishes, birds, reptiles—all these are egg-laying animals; and though their eggs differ in size, in shape and even in their constituent parts, they are all alike in one thing.

What Is an Egg? This one thing which all eggs must possess is the *embryo, nucleus,* or *germ,* from which the young animal develops. It is always small, and frequently so tiny as to be almost invisible, but it is the only part of the egg which has in it the possibility of life. All the other parts, frequently bulky in proportion to the size of the nucleus, are for food and for protection. The eggs of insects and of many of the lower animals, frequently produced in amazing numbers, are imperfect—that is, they do not possess the protective coverings which form part of the eggs of birds. If they did, and thus escaped in larger measure the destruction which waits for them on every side, the world would literally swarm with the young which would come from them.

A Typical Egg. Most perfect and most interesting, as well as of most importance commercially, are the eggs of birds. A bird's egg consists of five parts: (1) the shell; (2) the double membrane lining the shell; (3) the white; (4) the yolk; and (5) the germ.

(1) The *shell,* which usually makes up about eleven per cent of the weight of the egg, is formed almost wholly of carbonate of lime. The eggs of some birds are as smooth and shiny as enamel, while others are dull and rough; some are white, or nearly so; others exhibit exquisite tints and markings, such as the olive-brown spots on the grayish-white eggs of the bobolink, or the reddish-brown marks on those of the meadow lark; but in any case they all fulfil their one purpose, which is that of protection. The smaller the bird, the thinner the eggshell is likely to be, for a tiny humming bird could not possibly peck its way through the thick covering from which the young ostrich chick emerges with ease.

(2) The thin, tough *membrane* which lines the shell and gives it added strength is somewhat felty and elastic. As stated above, it is double, and at one end the two layers are widely separated, an air-chamber filling in the space between the two. This air, it is believed, is breathed by the little chick while it is pecking its way out.

(3) The *albumen,* or *white,* a food layer which contains a large proportion of water, has running through it two threads, or *chalazae;* everybody has noticed them, with impatience, probably, in a soft-boiled egg. Their function is to hold the yolk in its place in the surrounding white, and they are able to perform this steadying task because they are fastened to the lining membrane.

(4) The *yolk,* a yellow ball surrounded by a thin, transparent membrane, is composed of one cell, the largest single cells known being the yolks of the larger birds' eggs. This yolk is a very rich, concentrated food, easy of digestion by the developing birdling.

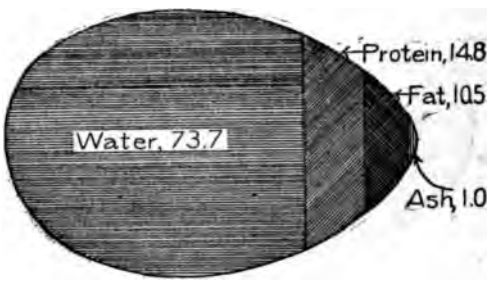
(5) Near the surface of the yolk on one side, and plainly visible in an egg which has not been brooded, is a circular white patch—

the all-important *vesicle,* or *germ,* from which the young bird is developed by incubation.

Hatching. The embryo can be developed only in one way, and that is by the application of heat. Occasionally, in the case of domestic fowls, this heat is artificially furnished, by some sort of an incubator (which see); but in nature the heat is supplied by the body of the female as it sits on the nest. In some species of birds the male sits on the eggs during the hatching period. A temperature of about 104° is needed to develop the eggs of fowls and most other birds, but there is a difference in the time required for hatching. Some small birds brood their eggs only about a week, but it takes three weeks to hatch the eggs of the hen, while those of the goose and turkey need four weeks of incubation.

Number and Size of Birds' Eggs. A full "set" or "clutch" consists of from one to twenty eggs, the number in a set being about the same for each species of birds. Among different species, however, the number varies greatly. The largest families are found among those whose young come into the world with a covering of down, and are able to run about as soon as they are hatched. Such birds require comparatively little care, and a numerous brood does not overtax the parents. The largest numbers are laid by members of the grouse, quail and duck families, represented by the teal, whose set comprises fifteen eggs; and by the partridge, which lays from twelve to twenty. The size of the parent bird, however, is also a determining factor, small birds never laying more eggs than their bodies will cover. But four young, for example, are hatched by the snipe and plover, though their little ones are not wholly dependent on the older birds. The number of eggs laid in a season is sometimes affected by accidental causes. For instance, when a nest is robbed the birds will often replace the stolen eggs. There is on record the case of a flicker, which laid seventy-one eggs in seventy-three days.

Generally speaking, the size of an egg is governed by the size of the bird which lays it; the ostrich, largest of all birds, lays an egg about six inches long, weighing nearly three pounds. From this size eggs of birds range down to the egg of the tiny humming bird. However, eggs of birds whose young are able to care for themselves are relatively larger than those of birds whose offspring emerge from the shell in a helpless, immature condition, for the former must remain in the protective shell a longer time than the less developed birds, and they must have sufficient room in which to grow. For this reason the spotted sandpiper, though about the size of the robin, lays an egg considerably larger than the robin's; likewise the meadow lark lays a much smaller egg than the upland plover, though the birds are practically equal in size.



COMPOSITION OF A HEN'S EGG

The above percentages include the contents of the entire egg. The illustration next following gives the analysis of white and yolk separately.

Eggs as Food

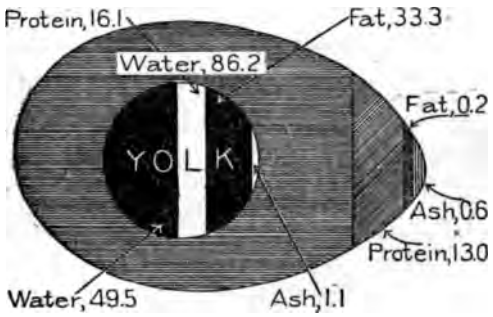
All over the world people use eggs as food, the eggs of fishes and reptiles furnishing not only delicacies but staples in some localities; but it is the eggs of birds, and especially of the domestic fowl, to which most importance attaches.

Food Value. An egg is almost as perfect a food as milk, but it lacks one valuable element which milk possesses, for it has practically no carbohydrates (which see). If served with something which supplies this lack, however, as rice, white bread or potatoes, eggs constitute an ideal food. They are easily and thoroughly digested, too, by nearly everybody.

As regards its constituent parts, an egg, freed from its shell, consists of 73.7 per cent water, 14.8 per cent protein, 10.5 per cent fat and about one per cent ash, and has a fuel value per pound of 720 calories (see CALORIE; FOOD, subhead *Chemistry of Food*). Comparatively speaking, the yolk has far more of the nutrient elements than has the white, the latter being 86.2 per cent water, 13 per cent protein, 0.2 per cent fat and 0.6 per cent ash, and having a fuel value of 250 calories to the pound, while the yolk is 49.5 per cent water,

16.1 per cent protein, 33.3 per cent fat and 1.1 per cent ash, and has a fuel value per pound of 1,705 calories. These figures are for hens' eggs, but the eggs of other poultry do not differ greatly.

Cooking Eggs. Eggs, it is estimated, form about two per cent of the food of the average Canadian or American family, and the methods of serving them, either alone or in



COMPOSITION OF WHITE AND YOLK
For analysis of entire egg, see preceding diagram.

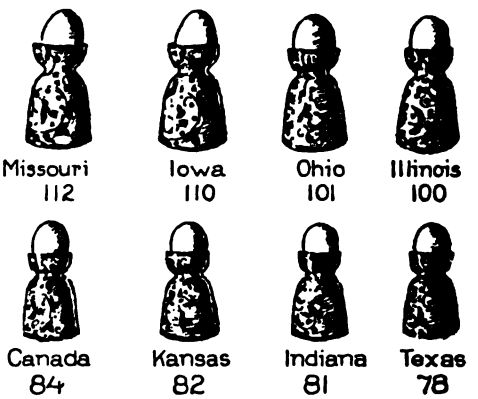
combination, are almost unlimited. Since they are a concentrated animal food, they are best served as a substitute for meat, not eaten with meat. It is impossible to give here specific directions for cooking eggs in all the various ways, but a few general principles may be stated. When eggs are "boiled," perhaps the commonest way of serving them, they are most palatable and most easily digested if they are not really boiled at all, but cooked in water below the boiling point. The white begins to coagulate or "set" at about 134° F., and at 160° is of a jellylike consistency—a "soft-boiled" egg in its best form. If allowed to remain long enough in water at this or a slightly higher temperature, the egg becomes "hard-boiled," but while it is firm it is tender as well, and has not the almost horny consistency of an egg cooked in boiling water.

Since cooked milk is also at its best if kept always below the boiling point, it is obvious that custards or other substances in which eggs are used to thicken milk should not be allowed to boil. If, however, cornstarch is used in addition, it must be boiled, but this can usually be done before the eggs are added.

How to Tell a Fresh Egg. Eggs but a day or two from the nest are far better flavored than those which have been held for a time, [redacted] if these latter are still in perfectly good [redacted]ion. Of the two most popular methods used for testing eggs, one makes no attempt to distinguish degrees of age, but contents itself with showing whether an egg shows signs of being addled or of starting to hatch. The other, within limits, shows whether an egg is fresh or simply well preserved.

The first method is known as *candling*. An egg, held in some device, as a pasteboard cylinder open at the ends, which shuts off the light from the sides, is held against a rather bright light. If it shows clear, it is fresh; if dark and clouded, it is addled; if a well-marked dark spot appears, the germ has begun to develop. In either of the two latter cases the egg is unfit for use.

For the *brine* method of testing, a salt solution made by adding two ounces of salt for each pint of water forms the basis. The eggs are placed in this brine, and those which sink immediately to the bottom are proved to be perfectly fresh—not more than one day old. But because evaporation lowers the density of eggs, an egg three days old will not sink to the bottom, but will be entirely submerged just below the surface of the water, while one

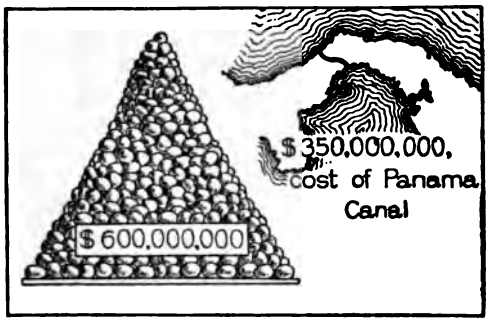


EGG PRODUCTION IN A YEAR
The statistics illustrated represent an average covering five years, ending with 1916.

more than three days old will float on top, the proportion of it which appears above the water being in proportion to its age.

Of course no such test can be looked upon as absolutely accurate, but both of these are satisfactory enough to be of the greatest importance commercially. Indeed, anything which concerns the commercial aspect of eggs is of importance, for it is estimated that there are more than a trillion and a half dozens produced in the United States each year. The

value of the eggs produced every year in the United States alone is about $600,000,000, while Canada produces annually about $25,000,000 worth. Their price varies according as



A STRIKING COMPARISON

The value of the eggs produced in a single year in the United States alone is sufficient to build nearly two canals like that at Panama.

the supply keeps pace with the demand. In periods of scarcity hens' eggs (strictly fresh) sell for as high as seventy-five cents a dozen, and the price ranges from this figure down to twenty cents or less. S.L.A.

EGGLESTON, *eg''ls tun,* EDWARD (1837-1902), an American novelist, author of *The Hoosier Schoolmaster,* one of the most popular books published in the nineteenth century. He was born at Vevay, Ind., was largely self-educated, as delicate health prevented his going to college, but he was a diligent student and acquired a wide knowledge of French literature, and some Greek. At the age of nineteen he entered the Methodist ministry and for ten years preached, sold Bibles and traveled in Minnesota for his health, and also engaged in such other pursuits as opportunity offered. Later he attracted attention by magazine articles and started his literary career in 1866 by becoming editor of the *Little Chronicle* at Evanston, Ill. In 1867 he removed to Chicago and edited *The National Sunday School Teacher.* Three years later he became literary editor of *The Independent,* New York, resigning that post to become editor of *Hearth and Home.* From 1874 to 1879 he was pastor of the Church of Christian Endeavor in Brooklyn.

In 1880 he retired to his home on Lake George, N. Y., and thereafter devoted himself wholly to literature. At this time Southern Indiana had come into prominence by his story of *The Hoosier Schoolmaster,* which first appeared in 1871 in serial form in *Hearth and Home.* This story was one of the earliest examples of realistic fiction portraying pioneer manners and dialect. Among his other novels are *Hoosier School Boy, End of the World, Mystery of Metropolisville* and *Roxy.* He also published biographies of American Indians for juveniles. The last years of his life were spent in writing a *History of Life in the United States,* but only two volumes were completed at the time of his death.

EGG'PLANT, a tropical vegetable belonging to the same family as the potato. It received its name from the fact that it is egg-shaped. Several varieties are cultivated in many parts of the world for use as table vegetables. In the United States it can be grown successfully as far north as latitude 42°. The purple-fruited varieties are favorites in the United States, the white ones being more popular in Europe. These fruits, from the size of a hen's egg to six or eight inches in diameter, appear on erect vines about two feet high. The leaves of the vine are prickly; the flowers, showy purple. Eggplant is served in several ways.

THE EGGPLANT

Smaller picture shows manner of growth of the plant.

It is best liked when sliced (not always peeled), dipped in a batter and fried in butter. It is as nutritious as cabbage or cauliflower.

A rich, deep, mellow soil is the best for eggplants. The chief difficulty in their cultivation is the start, as they must be raised from the seed in a hothouse or frame. They are not subject to very destructive diseases and they are worthy of more attention than they now receive.

EGLANTINE, *eg'lan teen,* a beautiful wild rose, commonly known as the *sweetbrier.* Its arching brown stems, with their sharp, hooked thorns, are thickly set with small, dark-green leaves and soft-pink blossoms, and leaves as well as flowers have a peculiarly sweet, spicy

scent. The presence of eglantine is thus easily detected, even before it is seen. When the flowers have fallen, bright red or orange fruits appear, larger than those of most roses, and the bush has thus another period of beauty. The sweetbrier has always been a poet's favorite, and references to it are many. Thus Shakespeare says:

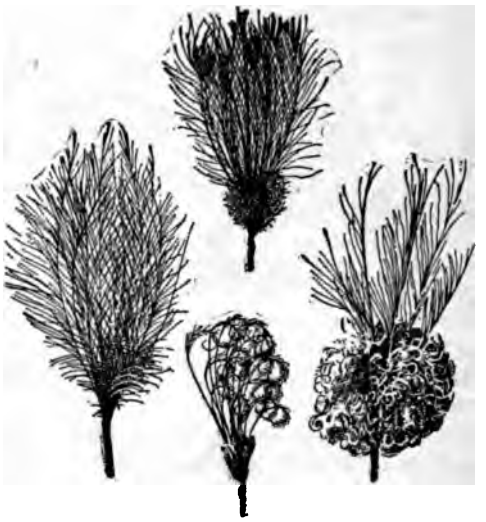
> Quite over-canopied with luscious woodbine,
> With sweet musk-roses and with eglantine.

EGRET, *e'gret,* or *eg'ret,* the French word for *heron,* a name given especially to the snowy-white species of heron from which milliners' *aigrettes* have been so inhumanely obtained. Three species are known in America, the tall, handsome *American egret,* the little *white egret,* which has the finest plumage, and the *reddish* egret. All were at one time numerous, especially in Florida, which was their breeding ground. They ranged from Patagonia as far north as Nova Scotia and Oregon. The greed and inhumanity of plume hunters,

THE EGRET AT HOME
American egrets and nesting grounds in the cypress swamps of South Carolina.

however, has nearly exterminated these beautiful birds. Two species are known in Europe, large and a small one, and in India they are especially abundant. For description and habits, see HERON.

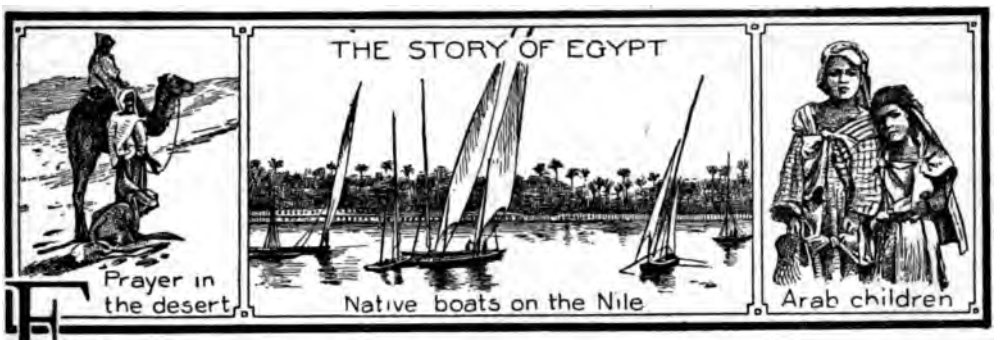
Aigrette, *a gret',* or *a'gret.* Since earliest times small tufts of egret plumage, mounted



PLUMES PREPARED FOR SALE

with jewels, have been worn as marks of honor by personages of rank in Oriental countries. The fashion spread to other countries, until finally aigrettes were worn on military hats and in women's hair and millinery. The demand for these beautiful, graceful ornaments grew so rapidly that the number of egrets has been greatly diminished everywhere. Those much-desired plumes, which grow between the shoulder-blades of the birds and extend to and beyond the tail, appear only in the nesting season. The killing of parent birds for the bridal-plumage therefore means starvation and death of helpless young. Realising the cruelty and inhumanity of such practice, various countries have adopted protective legislation, thus reducing the number of aigrettes offered for sale and increasing their price. An ounce of egret plumes has brought $54 in the London market.

In India, however, a humane method of obtaining aigrettes has been discovered and adopted, and the aigrette industry has become very profitable there. Egrets are bred in captivity. The plumes, or aigrettes, are plucked just as are those of ostriches, without injury to the bird. When about a week old the young are taken away from the parents and are reared by hand. The parents then breed again, and aigrettes are in that way obtained four times a year. M.S.



EGYPT, the "nursery of the world's art and civilization," is practically the flood plain of the Nile River; for beyond the limits reached by irrigation, the Egypt of geography is an irreclaimable desert. In all the world to-day there is no other country which has had so long an existence as has Egypt. Hundreds, even thousands, of years before the siege of Troy or before Abraham went out from Ur of the Chaldees, it was a settled country with a well-established government and a high culture, its greatness being due very largely to the control of the world's productive copper mines. Ever since the beginning of the Christian Era its history has been one of subjection and at times of oppression, but the people have preserved their identity, and the Egyptian of pure blood to-day has much the same cast of features which is to be seen in the mummy that dates from thousands of years ago.

Egypt includes the lower part of the Nile basin, in the northeast corner of Africa, extending from the Mediterranean Sea on the north to the Nubian Desert region on the south. Its greatest north-to-south length is 675 miles, its average width, about 500 miles, and its area about 400,000 square miles. Thus it more than equals in size Texas and New Mexico together, and is nearly as large as the province of Ontario, but only about 10,000 square miles, comprising the fertile Nile Valley and delta, can be successfully cultivated, and nine-tenths of the people are crowded into this section, which is but little larger than Vermont.

The People. Like most countries of the Orient, Egypt has no accurate census, but its estimated population is about 11,297,000. Of these, 10,366,000 are Egyptians, most of them of mixed Arab and negro blood, and fewer than 1,000,000 are Turks or Europeans. The term ***Egyptians*** includes several more or less distinct classes—the *fellahs* (peasants), Arabs, Copts and Bedouins; while of the foreign element the Greeks and Turks are most numerous, the Italians, British and French ranking next in order. Considering Great Britain's close connection with Egypt, it is rather surprising to find that in the whole country there are only about 21,000 British. The Bedouins are the desert-dwellers, the Arabs live in the towns, but the vast bulk of the population throughout the country districts is composed of the *fellahs,* who must be considered the representative Egyptians.

National Character. In the olden days the Egyptians maintained their kings like any other nation, but the national character was never strong, and one dynasty after another fell before outside conquerors. To-day but the slave class survives in the fellahs—those gentle, docile peasants, whose dominant trait is servile obedience to authority. Good-natured they are and very industrious, but they have no independence, no manly pride, no initiative ability. Their politeness is proverbial—one traveler tells of having inquired of a boy on a winding road whether he was journeying in the right direction to reach a certain town and of having received the answer, delivered in all seriousness, "Yes, your excellency, and had we known you were coming this way we would have had a road made straight for you." But like many exceedingly polite peoples, they are deceitful and cruel. Most of their faults may be traced, however, to the oppression which they have suffered under past government.

Mode of Life. In the towns foreign customs have been introduced and modes of living have changed, but in the peasant villages life goes on much as it has for centuries. There are picturesque features, but little that makes for comfort or pleasure. Except for an occasional religious festival there is no recreation,

and even the little children work from daylight till dark. A typical village, unless quite modern, has walls about it of sundried mud, broken only by the heavy wooden doors in which each street ends and which are closed at night. The one-story huts are also of mud and are built close together, with their flat roofs continuous, so that the goats, sheep and half-wild dogs may roam about over them at will.

Few of the huts have windows, the little door serving for ventilation, and since the streets are very narrow and the fires very smoky, the Egyptian peasants have little pure air to breathe in their homes. Since they are out in the fields most of the day, however, and make use of their homes only at eating or sleeping time, they seem fairly healthy. Rice is the chief food, and coffee, which the poorest family knows how to make excellently, is the well-nigh universal drink. Each village has its guest-chamber in which the chance traveler is fed and lodged, but this is often so dirty that the traveler prefers to do without food and rest rather than to endure it.

Religion. The Copts still hold to their ancient Christianity, and a few people in the towns have embraced that religion, but the great mass of the people is Mohammedan. Their religion is not a surface affair merely, but forms and regulates their lives. God, or Allah, is their personal deity, to whom they can appeal as a father, and the fatalistic doctrine which is so large a part of Mohammedanism prevents them from grumbling at any misfortunes which may befall them. A very strong influence is exerted by religion upon hygiene, for since a Mohammedan may not pray unwashed, ablutions are much more common than they would otherwise be. To men, the religious duties and observances are all-important, but not so to the women. The latter are not allowed to enter the mosques during prayer, and though they are permitted to pray in their homes it is not required of them. Polygamy is legal, but most Egyptians content themselves with one wife. If, however, a wife angers her husband or bears him no children, he may take a second wife or may divorce her by merely saying, "Thou art divorced."

Education. As their religion seems to take it for granted that a woman has no soul, so the educational scheme assumes that she has no mind. Naturally such an attitude works *untold* injury to the country. A woman is not even taught how to care for her children. If a baby be born to her while she is working in the fields she wraps it in a handkerchief and lays it under a bush in the shade. Later, perhaps, she returns to find that the shadows have shifted, and that the hot sun has killed her baby, but she only says, "It is Allah's will," and returns to her work. As a result of such gross ignorance, it is estimated that about ninety per cent of the babies born to the purely-native population die in infancy.

The men among the peasants are but little better educated than the women, few of them knowing how to read and write. So general is illiteracy that a written signature to a document is exceedingly rare. Where there are native schools they merely teach by rote portions of the *Koran.* In the towns, however, education is farther advanced, and the old conservative method of teaching from the Koran is gradually giving place to something like a liberal system.

The Geography of Egypt. Geographically Egypt has two regions—*Lower Egypt,* which stretches from the Mediterranean to Cairo and consists largely of the Nile delta; and *Upper Egypt,* from Cairo to the southern boundary, a fertile valley nowhere more than fifteen miles broad. These two divisions constitute the part of Egypt which is known as "the gift of the Nile," for only as that river furnishes its waters and the fine silt which remains after its annual overflows has any agricultural development been possible. It is in these two regions that the greater part of the population lives, for only a very precarious living is to be obtained elsewhere. See NILE.

West of the Nile are the barren, rainless stretches of the Libyan Desert. This, in the main, is a region of wind-blown rock waste, but here and there are areas which are watered from subterranean sources or by canals leading to them from the Nile. These are the famous oases, the rich, fertile spots which have an added interest because of their situation as verdant islands in a vast sea of rock waste. East of the Nile is another desert region, but it is mountainous, rising gradually until near the borders of the Red Sea it attains a height of several thousand feet. In the high places there is a little vegetation, and there the Bedouins pasture their wandering flocks.

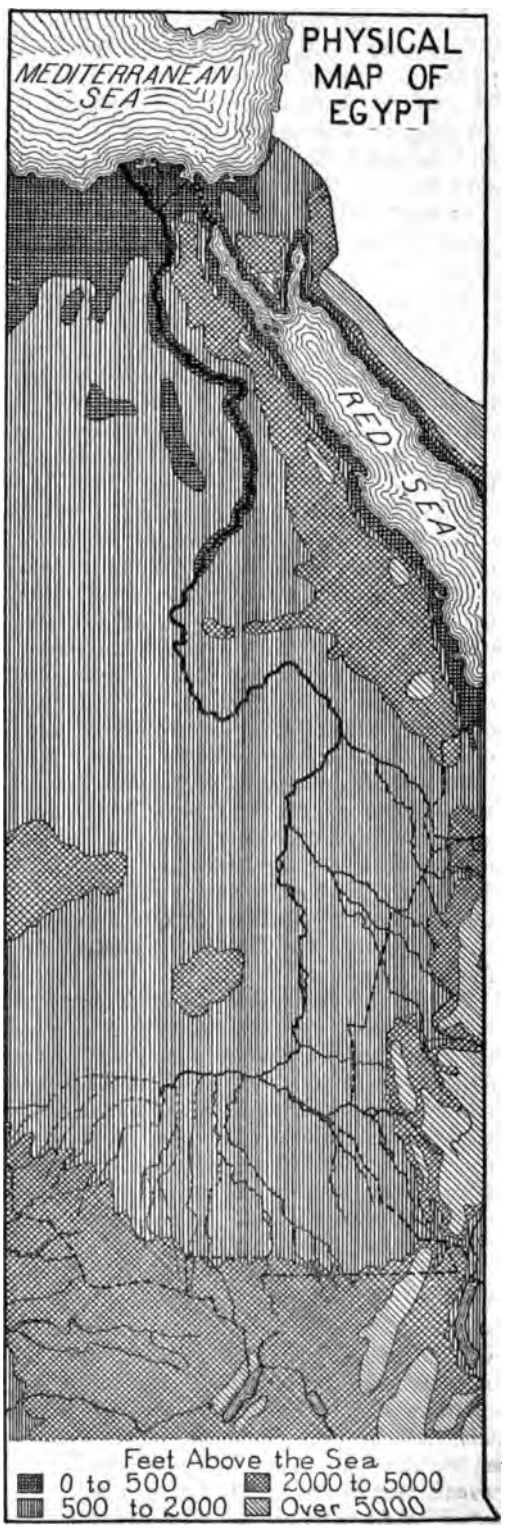
A discussion of the waters of Egypt can deal with but one topic—the Nile. Since that, with its influence on the country, is given full treatment in the article under its own name,

not be discussed here. There is prob-
ıowhere else in the world an instance of
utter dependence of a country on a
vay.

culture. Among the delights of Egypt
ȝ sunny skies and its dry air, but for
the country has to pay heavily, for the
l is so light that without irrigation
lture is impossible. And yet, notwith-
ng this drawback, Egypt is primarily an
ltural country, and two-thirds of the
ıg people are engaged in tilling the soil,
igation is widespread. In Lower Egypt
is an extensive network of canals, many
:m navigable, and from these water is
ıt over the fields until a great area is
ɔrmed into a vast garden. Since there
cold weather, three crops a year are
in this northern section, wheat, beans,
and clover being produced in the win-
otton, sugar cane, millet, rice and fruit
summer; and maize and millet in the
season. Particularly valuable among
Lower Egypt crops is the long-staple
,' used in making thread and hosiery.
one-tenth as much is produced as in
nited States, but efforts are being made
e English to extend its cultivation to
Egypt.

ı latter region was for years dependent
irrigation of the most primitive sort.
ȝ the flood season the water was col-
in big mud basins, and after the Nile
subsided it was let out upon the fields.
ıften, however, it did not last through
:y season, and parched crops were the
With a view to remedying this con-
a barrage was constructed at Assiut,
great dam known as the Assuan Dam
ected near Assuan in 1902; in 1912 this
considerably enlarged, so now the
-up waters reach the tremendous vol-
f nine million cubic feet, and large new
are made cultivable. Upper Egypt
chiefly grain, vegetables and fruit, but
tton culture is increasing in importance.
ɔughout Egypt most of the land is
by those who work it, and the former
tant rental rates have been lowered dur-
ȝ British protectorate. Methods of agri-
ȝ are most primitive, but the fertility
soil makes up for this, little more than
:ching with the old wooden plows being
ıry to secure good crops.

r Industries. The only manufacture of
nportance in Egypt is the making of



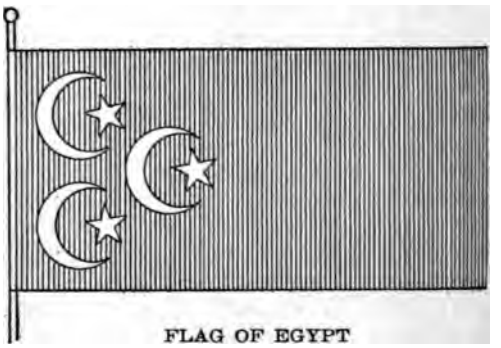
cigarettes from Turkish tobacco. To protect this industry a heavy export tax is levied on native tobacco, which is inferior in quality. Mehemet Ali granted various monopolies and encouraged the founding of a number of industries under the control of the state, but since his time these have all been closed.

In its mineral resources, too, Egypt is very limited, though gold-mining is carried on to some extent in the eastern mountains, and oil wells have been sunk on the eastern coast. That there was once an enormous quantity of stone available is evident from the great buildings and monuments left by the ancients, but at present the output of the quarries is not large. Other mineral resources there may be, but the drifting rock waste has covered them deep.

Commerce and Transportation. Before Great Britain assumed control the commerce of Egypt was very small, but to-day it has a very considerable foreign trade, chiefly with Great Britain. Practically the only things which Egypt itself has to export are cotton, grains and cigarettes, but from its great port of Alexandria are shipped also the ivory and the ostrich plumes which are brought by caravan from the interior of the continent. The United States imports much Egyptian cotton, 100,000,000 pounds a year being no unusual amount. Egypt's imports consist largely of manufactured goods—textiles and metal articles, wood, coal and metals. The internal trade is largely carried on by Arabs and native Egyptians, but Europeans manage the foreign commerce.

The Nile, indispensable for other purposes, is also valuable as a waterway, for it is navigable to the first cataract, just north of the southern boundary. The state owns and operates over 1,500 miles of railway and in addition there are about 1,300 miles of so-called agricultural roads owned by private corporations. These connect the agricultural regions with the main lines of railway and provide transportation for the produce of the country.

Government. For centuries Egypt has been tributary to Turkey in theory, but during the nineteenth century the native ruler was practically absolute. True, he had a Turkish commissioner in his council and he had to pay a large annual tribute, but his office was hereditary and no one questioned his acts so long as he did not attempt to extend his power beyond Egypt. During the latter part of the *nineteenth century England* became so involved in the financial affairs of Egypt that a British representative was sent to take charge of the revenue (see subtitle *History*, below), and gradually the hold of Great Britain on the country was strengthened until Egypt became practically a British dependency. Theoretically the khedive is still the head of the government and rules with the aid of a legislative body of eighty-nine members, three-fourths of whom are elected by the people. There is also a council of six ministers who preside over



FLAG OF EGYPT
White crescents and stars on red background.

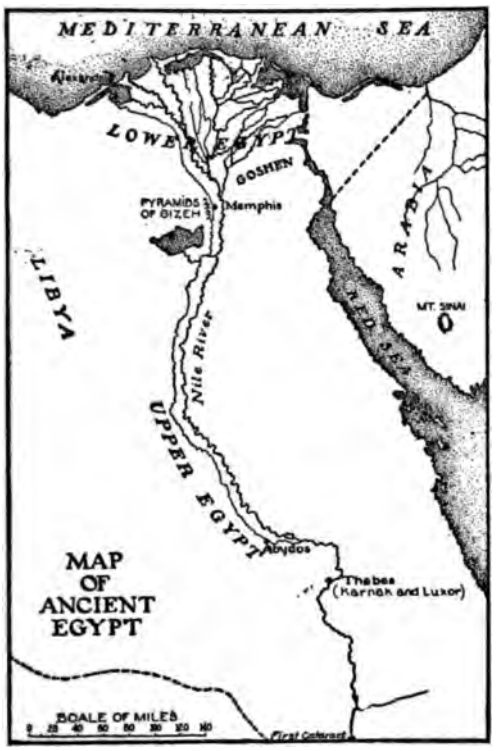
departments of the interior, finance, war, marine, justice and public works and instruction. Several of the ministers, and those the most important, are Europeans. Travelers in Egypt declare that since Great Britain assumed control Egypt has been one of the best-administered countries in the world because usually the best possible man has been placed in each office, without political consideration.

The cities of chief importance are Cairo, the capital; Alexandria, the principal seaport; Rosetta and Damietta, at the mouths of the Nile; and Suez and Port Said at the terminals of the Suez Canal. The most important towns are described in alphabetical order in these volumes.

Ancient Egypt. This is the phase in the life of the country which is most likely to come to mind when the name Egypt is spoken, and indeed the history of the world presents few greater marvels than the high civilization which this Nile Valley region developed so many thousand years ago. What sort of people were dwelling in Europe in those olden days and on what low plane of existence they were living, no one can even conjecture, but in Egypt innumerable relics tell the story of that ancient time, even revealing much of its every-day methods of life.

Learning. First of all, the Egyptians had a system of writing, called the hieroglyphic. It

did not have an alphabet, but conveyed information by means of pictures, which seem to have answered very well all their purposes. A literature existed which had its beginnings very early, and consisted not only of inscriptions on tombs and monuments, but of real



papyrus books as well. To decipher this old writing was a very difficult task for modern scholars, and only after the discovery of the Rosetta Stone was it satisfactorily accomplished. The ancient Egyptians seem to have been very fond of stories, and manuscripts are found of tales which bear a curious resemblance to many of the tales of magic which date from medieval or modern times. For instance, the prince who is shut up in a castle by his father to escape some horrible fate which had been prophesied is a familiar figure in those old Egyptian stories who has corresponding characters in more than one modern tale.

Astronomy, and its older phase, astrology, were known to the Egyptians, and they had a considerable knowledge of arithmetic. They used the bellows and the blowpipe, the lever, the balance and the siphon, and they knew how to obtain the fiber from flax and spin it into cloth.

Art. Certain branches of art the Egyptians had evolved to a high degree of excellence. Their buildings were for the most part not specially graceful or beautiful, but they were massive and imposing, while their sculptures, if showing no knowledge of perspective and lacking ease and naturalness, convey the ideas of strength and of vigorous action. Beautiful, glazed pottery, filigree and inlay work of rare design, have also been found in their old tombs and temples, and specimens of skilfully enameled jewelry are numerous.

Religion. The dominating religious tendency was a belief in the immortality of the soul, and the conviction that some day it would return to the body, which must be preserved in readiness to receive it. It was this belief which led the ancient Egyptians to embalm their dead so carefully that many of the bodies have been preserved in an excellent state until the present time, and to erect such vast burial places as the Pyramids. In the MYTHOLOGY index may be found a subhead treating of Egyptian mythology, while in the article TRANSMIGRATION OF THE SOUL is a discussion of the curious belief which resulted in the setting aside of a number of animals as sacred.

History of Egypt

Just how old was the civilization of this most ancient of countries cannot be known, but it is certain that Egypt was a flourishing nation long before 3000 B.C. The monuments and inscriptions tell much concerning the ancient period, but leave much in doubt as to chronology. Thirty dynasties of kings, according to the old historian Manetho, ruled in succession; some were comparatively insignificant, some very powerful and determined to leave their impress on the people. The Fourth Dynasty, for instance, which was at its height about 2800 B.C., left as its memorials the greatest of the Pyramids. From 1700 to 1600 B.C., or thereabouts, the country was under the sway of foreign sovereigns who ruled by conquest—the Hyksos, or Shepherd Kings; and after they were driven out there came a wonderful period when the Theban kings reveled in the building of magnificent palaces and temples, the ruins of which still exist at Thebes.

Seti I and Rameses II (see articles under

these names) were the outstanding kings of the famous Nineteenth Dynasty, the latter reigning about 1330 B. C. Until recently it has been believed that Rameses II was the king who "knew not Joseph" and who oppressed the Israelites, and that the Exodus occurred under his son Mernephtah, but inscriptions lately deciphered have proved that this is impossible. With the Twentieth Dynasty came a weakening of power, and gradually Egypt passed under the sway of outside countries. First Assyria (670 B. C.), then Persia (525 B. C.), then Greece, had its will with the country, Alexander the Great being received as a veritable deliverer because the people had suffered so severely under Persian rule.

Egypt under the Greeks and Romans. Until his death Alexander was lord of Egypt, and then one of his generals, Ptolemy, was made king. Alexander's new city, Alexandria, was made the capital, and the new Greek state acquired practical independence and a foremost place among the countries of the world. Never before had Egypt been so prosperous, for the first Ptolemy was a strong and wise sovereign, and some of his descendants were not unworthy of him. Commerce flourished, the people had enough to eat, and Alexandria became the center of the intellectual and literary life of the world. In the second century B. C., a period of decline set in, and the later rulers of the Ptolemaic dynasty were forced to ask aid of Rome in their external and internal troubles. The last sovereign, Cleopatra (which see), maintained her independence only because her beauty brought her the favor of the Roman rulers, and after her death the country became a province of Rome. Under the empire there were few disturbances in Egypt, and the most interesting event was the spread of Christianity among the people. In the later divided condition of the Roman Empire, Egypt was neglected, and in 641 was conquered by the Saracens with little opposition.

Under Mohammedan Rule. This African province was a very important Mohammedan possession, and Cairo was a center of Moslem life. The Crusaders made Egypt one of their points of attack but accomplished nothing lasting, and from the thirteenth to the sixteenth century the country was sinking constantly lower into anarchy and wretchedness. The Mameluke chieftains were conquered by the Turks in 1517, but their real power was *not* broken, and it was the Mamelukes whom Napoleon encountered on his invasion in 1798. He gained control of the country, but in 1801 was driven out by the Turks, with the aid of the British.

Nineteenth Century Egypt. After the expulsion of the French, a Turkish soldier, Mehemet Ali, was made pasha, and as he was a man of great ability his long rule was one of progress. He succeeded in making the country practically independent, though he was forced to acknowledge the nominal authority of Turkey, and he extended Egyptian territory materially and improved agriculture. His reign was a hard one on the people, however, for he laid upon them terrible burdens of taxation. Under the rule of his successors, Abbas Pasha and Said Pasha, the taxes were lessened and the country was placed upon a firmer footing financially. It was during the reign of Said that the Suez Canal was begun.

Ismail Pasha, a grandson of Mehemet Ali, became the head of the government in 1863, and four years later took the title of khedive, which in Persian means *prince*. His administration was vigorous but exceedingly extravagant, and the finances of the country were brought by him into the utmost disorder. Forced by financial necessity to sell his stock in the Suez Canal to Great Britain, thereby giving the British a majority of the shares, he thus gave that country its first hold on Egypt, and in 1876 was compelled to allow European commissioners to take control of the revenue. In 1879 the French and British governments obliged him to abdicate in favor of his son Tewfik, and in the next year a joint French and English control over the country was established. The so-called national party revolted in 1882, and forced the khedive to flee, but a British fleet bombarded the city on July 11, and restored him. Since the dual control system seemed to lead to endless difficulties, the arrangement was modified so that the country became practically a protectorate of Great Britain, though the khedive remained the nominal head.

The next event of outstanding importance was the rebellion in 1884 of the Mahdi, and Gordon's expedition into the Sudan with its tragic outcome. After that the Sudan remained quiet for more than a decade, but in 1894 another insurrection occurred, which the new Egyptian army under Kitchener put down in a series of campaigns ending in 1898. Tewfik died in 1892, after a long and wise rule, and his son Abbas Hilmi succeeded. This able

EGYPT

The Vocal Memnon

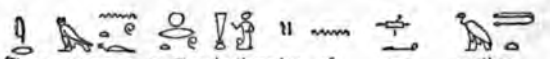
On the Banks of the Nile Today

Colossus of RamesesII, at Luxor

Temple at Philae, below Assuan

Mummy of Seti I

Standing in Majesty through 5000 Years



Ancient Egyptian Writing, with Translation

Cartouche of Khufu

Hall of Columns at Karnak

A Queen of Old Egypt

Gateway at Karnak

Outline and Questions on Egypt

Outline

I. Location and Size

(1) Latitude and longitude
(2) Boundaries
(3) Greatest length and breadth
(4) Actual area
(5) Comparative area

II. Physical Features

(1) Lower Egypt
(2) Upper Egypt
(3) Desert regions
(4) The all-important Nile

III. Industries

(1) The chief industry—agriculture
  (a) Where carried on
  (b) Products
  (c) Irrigation
(2) Manufacturing
(3) Mining

IV. Transportation and Commerce

(1) The Nile as a waterway
(2) Railroads
(3) Roads
(4) Growth in commerce

V. The People

(1) Characteristics
(2) Mode of life
(3) Education
(4) Religion
(5) Different races

VI. History and Government

(1) Ancient Egypt
(2) Foreign domination
(3) Effect of War of the Nations
(4) Government
  (a) Part taken by Great Britain

Questions

How large a percentage of the babies of the natives live past their infancy?

How carefully must land in the irrigated districts be cultivated in order to yield?

What justice is there in calling Egypt the "nursery of the world's civilization"?

What is taught in the native schools of this country?

Of what important principle of art did the ancient Egyptians show no knowledge?

What gave Great Britain its first hold on Egypt?

What effect does an Egyptian's religion have on his cleanliness?

Tell the interesting story of the decipherment of ancient Egyptian writing by means of the Rosetta Stone.

Describe a typical native village.

Who was the most famous ruler Egypt ever had?

What has the national character had to do with the political history of Egypt?

Why is the country called "the gift of the Nile"?

To how many countries has Egypt belonged?

Who are the *fellahs?* How large a part of the population consists of them?

Who were the Shepherd kings?

What part did Kitchener play in the history of Egypt?

What religious belief did the embalming of the dead grow out of?

Who was "Chinese Gordon"? What did he have to do with Egypt?

and progressive ruler did much for the country, seconding every suggestion which Great Britain made for its improvement, and under the highly capable guidance of Lord Cromer, Egypt has been practically remade economically.

Recent Events. The nationalists have not been satisfied. They have struggled constantly for independence, one of their measures having been the presentation, in 1906, of a monster petition to the visiting Prince of Wales, begging for the removal of Great Britain's control. An Egyptian prime minister was assassinated, outbreaks occurred in all the large towns, and in 1912 a plot for the assassination of Kitchener, the viceroy, was discovered. By his well worked-out constitutional reforms, however, Kitchener did much to quiet the disorder.

In 1914, after the outbreak of the War of the Nations, Egypt was put in a state of war under protection of Great Britain, and, in the main, feeling in the country remained loyal to the British rule. A formal declaration that "Egypt is placed under the protection of his Britannic Majesty" and that "the suzerainty of Turkey is thus terminated" was issued on December 17, 1914, and on the following day Abbas Hilmi was deposed, his uncle, Hussein Kâmil, succeeding him with the title of sultan of Egypt. The Germanic powers, Germany and Austria-Hungary, with the help of their ally, Turkey, attacked Suez in 1915, with the hope of destroying the canal and invading Egypt, thus lessening Britain's power. Each of several successive attempts failed. J.R.

Consult Low's *Egypt in Transition;* White's *The Expansion of Egypt;* Todd and Du Cane's *The Banks of the Nile.*

Related Subjects. The reader who is interested in Egypt will find much that is helpful in the following articles in these volumes:

CITIES AND TOWNS

Aboukir	Khartum
Abydos	Memphis
Alexandria	Port Said
Assuan	Siut
Cairo	Suez
Fashoda	Thebes
Heliopolis	

HISTORY

Cleopatra	Mamelukes
Gordon, Charles George	Pharaoh
Hyksos	Pharos
Khedive	Pyramids
Kitchener, Horatio	

LEADING PRODUCTS

Cigarette	Rice
Cotton	Wheat

UNCLASSIFIED

Architecture	Papyrus
Astrology	Philae
Cape-to-Cairo Railway	Rosetta Stone
Hieroglyphics	Scarab
Mummy	Sculpture
Nile	Sphinx
Nomad Life	Suez Canal

EIDER, *i'der,* **DUCK,** a duck of the sea from whose breast is obtained the soft, warm down used in coverlets and pillows, especially in European countries. It is larger than a common duck, but not as large as a goose. Two species are known to sportsmen in America, from the coasts of Newfoundland and Labrador southward to New England and west to the Great Lakes.

THE EIDER DUCK

The best known and most important eider, however, is the European species. The male is mostly black, with back and head creamy-white. The female is reddish-drab, streaked with brown and black. Differing from the American species, the male has a green instead of black patch on the crown. Eiders frequent solitary rocky shores and islands and feed on fish, for which they dive.

Eider-down. The soft, mouse-gray down of commerce is obtained chiefly from Iceland, although Norway and Greenland have valuable *eider-folds.* Down found in the grass and seaweed nests of eider ducks is the most valuable, and is called *live* down, for it has been plucked chiefly by the female from her own breast to soften her nest and protect her eggs and young. Down taken from dead birds is called *dead* down. About one-half pound of eider-down is taken from one nest each year. Five pounds of the best quality are enough for a bed. Two or three pounds of down, however, can be put under pressure and reduced to a ball the size of a man's fist.

EIFFEL, *ef el',* **TOWER,** a colossal steel skeleton structure on the Champs de Mars, Paris, erected for the exposition of 1889, and named after its projector, Gustave Eiffel. A marvel of engineering design and execution, it still stands as one of the interesting and ornamental features of Paris. It is 984 feet high and 330 feet square at the base, and is constructed of iron lattice-work, elevators and stairways giving access to its platforms or galleries. The latter are occupied by restaurants, physical and biological laboratories, and by the experimental station of the French Weather Bureau. The tower contains 7,300 tons of iron and steel, and cost over $1,000,000, about thirty per cent of which was voted by the government and the remainder supplied by M. Eiffel, who was to be reimbursed for his advance from the profits derived from admission fees to the tower for a period of twenty years. The receipts for the year 1889 alone practically covered the cost of construction. The great height of the structure, exceeding that of any other in the world, made it an important military observation station during the War of the Nations, which began in 1914. Repeatedly the Germans attempted its destruction by hurling bombs from airships.

EIFFEL TOWER

Alexandre Gustave Eiffel (1832-), famous as the designer of the Eiffel tower, first achieved prominence by his employment for the first time of the compressed air method of sinking foundation cylinders in bridge construction. He engaged in many other important engineering activities, among them being the construction of great bridges, the building of the iron frame work of Bartholdi's Statue of Liberty in New York harbor, and the designing of the gigantic locks of the Panama Canal, when it was under French control. In 1893 he became involved in the Panama Canal scandal, and was convicted of misappropriating the funds of the Canal Company; for this he was sentenced to be fined and imprisoned, but the sentence was annulled. He thereafter devoted his time to the study of air resistance, and in 1913 published a book that was of great value to aeronautical engineers.

EIGHT-HOUR DAY, a term which relates to eight hours of work a day. The effort to limit the working day to eight hours is chiefly the outgrowth of two causes, the development of the factory system of industry and the rise of labor organizations. The arguments in favor

of it are obvious; the person who works more than eight hours becomes more or less exhausted, physically and mentally, turns out poor work, and eventually loses his health. The only serious objection to the eight-hour day is advanced by some employers who maintain that it reduces profits to the vanishing point. While this may be true in rare cases, it has been scientifically determined that the average workman, under good working conditions, will turn out week after week as large a product in eight hours daily as he will in nine or even ten hours.

In a few industries nine-, ten- and twelve-hour days are still the rule, but nearly all skilled laborers now work only eight hours. In the building trades, in coal-mining and in the printing trades, for example, the labor unions have been able to bring sufficient pressure on their employers to obtain the eight-hour day. The movement has also received great support from the Socialists, who have generally adopted the eight-hour day as one of their principles. In the United States and Canada nearly all work for the national or local governments is now done on an eight-hour basis; a law passed by Congress in 1912 provides an eight-hour day on all contracts for work for the Federal government. In Arizona, Colorado, Montana and other mining states, eight hours is the limit for work underground, and in some states for all work in or about mines.

In 1916 the Congress of the United States passed the so-called Adamson law, giving to 400,000 railway trainmen an eight-hour day. The railroad companies protested against the injustice of the law, as it raised wages over twenty per cent without permitting them to increase their income to meet the added outlay. The case was pending in the Supreme Court in the early months of 1917.

In England the eight-hour day has become the rule rather than the exception in all skilled trades, chiefly through the power of the unions. In France and Germany considerable progress has been made, but the leader in the movement is Australia, where some of the labor organizations in Melbourne as early as 1856 secured an eight-hour day. W.F.Z.

EKATERINA, *yeh kat ye re'na,* Petrograd's new commercial port in Russian Lapland, situated on a far northern coast at a point where the warm Gulf Stream mingles with the waters of the Arctic Ocean. The town lies 700 miles north of Petrograd and sixty-six miles east [redacted] Norwegian boundary. It is 600 miles nearer the Atlantic than is the ancient port of Archangel, on the White Sea, and owing to the influence of the Gulf Stream, its harbor is ice-free throughout the year. When the War of the Nations broke out trade channels through the Baltic Sea to the Atlantic were closed, and

THE ICE-FREE PORT

Russia was forced to depend solely on Archangel to obtain supplies and munitions of war from its allies. The harbor of Archangel is ice-bound at least six months of the year, and it is served only by an inadequate, single-track, narrow-gauge railroad.

Ekaterina lies in a region of fir trees, barren rocks and lonely swamps, and for half of the year is shrouded in winter darkness, but over the 700 miles of unbroken country between it and Petrograd the Russians constructed a double-track railroad, which was partly open for traffic in 1916. The new port will entirely supersede Archangel as a trade outlet, for the latter is to be used hereafter only for military purposes.

E'LAND, the Dutch name for the largest antelope found in Africa. It is fully six feet in height, as large as a full-grown horse, and weighs 1,000 pounds or more. It was called *elk* by the early settlers in South Africa. The flesh is decidedly palatable, and the hide is used for harness. The slow movements and gentle manner of the animals make their capture an easy matter, and in consequence they are

being exterminated. A larger species is found in Western Africa. For illustration, see page 278.

ELASTICITY, *e las tis'i ti,* a term used in physics to designate that property by which bodies resume their original size and form when the external force by which their size and form have been changed is removed. All substances possess this property in some degree. Elasticity is of two kinds, elasticity of *volume,* which is the property of gases and liquids, and elasticity of *form,* the property of solids. Solids that have little ability to resume their original shape after the action of stress or pressure are said to be *inelastic,* or *plastic.* When a body has reached its elastic limit, further stress or pressure will cause permanent change of form or size. This is illustrated by a rubber band which has been stretched until it will not resume its original size. Elasticity may be developed by pressure, pulling, bending or twisting. Gases are the most elastic substances. Hard solids are more elastic than soft solids. Such substances as lead, putty and dough have very little elasticity. See PHYSICS; MATTER.

EL'BA, an Italian island in the Mediterranean Sea, six miles west of the mainland, historically famous as the enforced residence of Napoleon Bonaparte after his first abdication in 1814. Here he remained, with supreme authority, until 1815, when followed the famous "Hundred Days" in European history, March 20 to June 28, from the date of his entry into Paris to the second abdication. The island is eighteen miles in length and three miles in width, and is mountainous in character. Its principal product is iron, but it is also rich in marble, wines and fruits. The sardine industry gives employment to a part of its inhabitants. It has two well-fortified seaports, as fortifications were understood before the War of the Nations; these are Porto Ferrajo, the capital, and Porto Longone. For governmental purposes it is a part of the Italian province of Leghorn. Its population is about 26,000.

EL'BE, a German river which is one of the most important commercial highways of Central Europe. It rises on the borders of Bohemia and Silesia, at an altitude of 4,000 feet, and after a course of 780 miles empties into the North Sea, at the port of Cuxhaven. Wherever possible the Elbe has been rendered navigable, and towns on its banks have vied with each other in building docks with improved loading, unloading and storage facilities. Dresden, Wittenberg, Magdeburg, Torgau and Hamburg are the most important commercial centers passed in its course, and each city takes the fullest advantage of the cheap transportation and water power it affords.

Steamers and barges navigating the Elbe outnumber those of any other German river.

COURSE OF THE ELBE RIVER

Ocean-going vessels ascend as far as Hamburg, eighty miles from the sea. The fisheries are valuable—sturgeon, shad and salmon being taken in great numbers. Vast quantities of timber are floated down the Elbe from the interior to the sea. A network of canals connects the river with the commercial centers of the surrounding territory, and in this way its advantages have been developed probably more than those of any other river in the world.

ELBERFELD, *el ber felt',* an important commercial town of Germany, forming practically one city with Barmen, although they are municipally separate. It is situated on both banks of the River Wupper, about fifteen miles northeast of Düsseldorf Elberfeld has long been a noted educational center, and it is only within recent years that it has assumed commercial importance. It is now the center of German cotton, wool, velvet and silk industries, and produces great quantities of chemicals and dyestuffs. Extensive foreign and domestic trade is carried on, and the city has excellent railway communications with interior and coast towns. Elberfeld owes its original industrial growth to Napoleon's continental system (which see), which prohibited all dealings with the British. Population in 1910, 170,118.

ELBURZ, *el boorz',* a chain of mountains in Northern Persia, extending from the western

shore of the Caspian Sea for a distance of 650 miles into Khorasan. The western portion runs almost parallel with the seashore, which at some places is only twelve miles distant. Numerous streams drain the northern slopes, which are covered with forests containing magnificent hardwood trees. The range contains many peaks over 10,000 feet in height, Demavend being the loftiest, with an altitude of 19,400 feet. The nomadic tribes of the surrounding plains take their flocks and herds to the slopes of Elburz in summer, finding there excellent grazing and plentiful supplies of water. See NOMAD LIFE.

EL CANEY, *el kah'na e,* BATTLE OF, a battle of the Spanish-American War, fought in Cuba, four miles northeast of Santiago de Cuba, July 1, 1898, between 4,500 United States troops commanded by General Lawton, and Spaniards, led by General Vara del Rey. The Spanish troops were well entrenched, and although numbering only 500, offered stubborn resistance. The Americans won the day, the casualties on each side numbering more than 400.

EL'DER, a genus of graceful, quick-growing, stout-branched trees and shrubs common along roadsides and fences throughout the United States, Southern Canada and Europe. There are about twenty species, all having opposite

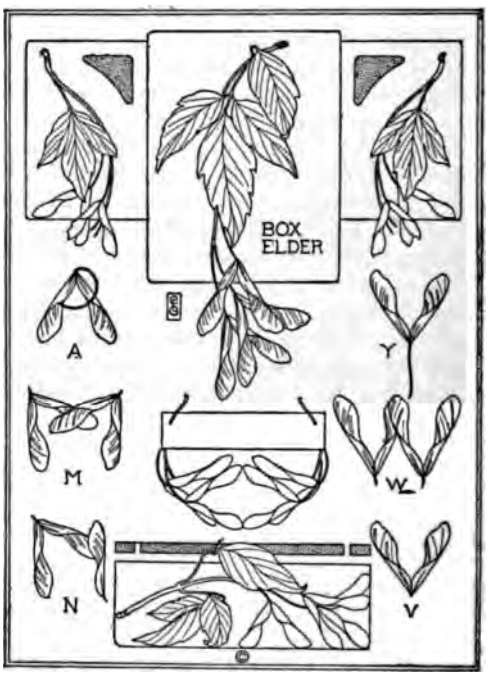
LEAVES AND FLOWERS OF THE ELDER

leaves, usually with finely-cut edges, and large flat-topped clusters of small white flowers. The juicy fruit is either black or red, with from three to five seeds, or nutlets.

Elder shoots, which are full of pith, are used by boys for making whistles and "pop-guns." The Greeks used to make a musical wind instrument, the *sambuke,* from hollow elder stems. Elders are valued chiefly for shade and ornament, although the wood of one European species is tough and hard and takes a good *polish.*

Uses of Berries and Flowers. Elder berries make excellent pies and wine, and are sometimes eaten off the trees by Indians and Mexicans. Occasional efforts have been made to improve the fruit, and work along those lines has already repaid experimenters. The flowers, too, are used for making wine, and also for a perfume and a "water" used in candies. The dry flowers are employed in medicine for their stimulating and carminative properties.

Box-Elder, or **Ash-Leaved Maple,** is a small but beautiful tree. It grows rapidly almost



SUGGESTIONS FOR BOOKLET

Small designs may serve as initial letters; at the bottom is a tail-piece ornament. The illustration at the top, with the border and central figure, makes an attractive cover design.

anywhere, and it is therefore a favorite shade tree. As windbreaks, or for planting timber claims, these trees are ideal; they also make good nurse trees for other species. The wood is soft and brittle and of little value, but is used for making bowls, pails and wood pulp, and as a fuel.

EL DORADO, *el doh rah'doh,* a Spanish word meaning *the gilded.* It was applied first to the chief priest of a South American tribe who is said to have covered himself with gold dust at a yearly religious festival; next, to a fabled city in South America called Manoa; and, finally, to a mythical country in which gold and precious stones were to be found in abundance.

These legends led to many expeditions among the Spaniards, who unsuccessfully explored for treasure. Sir Walter Raleigh, who took up the search in 1595, described Manoa as a city on Lake Parima, South America, but its existence was later disputed by the geographer Humboldt. The name *El Dorado* is to-day applied figuratively to any locality where wealth can be acquired rapidly.

ELECAMPANE, *el e kam pane'*, a sweet herb especially popular in European and Asiatic gardens in the Middle Ages, and still cultivated there and in America. The flowers are compound and of yellow or orange hue. The root leaves are often two feet or more in length, the plant itself growing three or four feet high. As a tonic and stimulant to the organs of secretion, the root with its bitter, camphorlike taste was at one time popular but is seldom used to-day. It is now chiefly employed in the manufacture of absinth in France and Switzerland (see ABSINTH).

ELECTION, *e lek'shun,* the process by which a free government or any organization or society chooses those who are placed in positions of authority. In the selection of all important officials safeguards are placed around election machinery; the usual form by which choice is made is by ballot, and some modification of the Australian ballot reform law has been widely adopted in England, Canada and the United States. The latter country is the only one whose entire voting population participates in any degree in the choice of its chief executive. The voters of each state, by constitutional provision, choose from their number as many electors of the President and Vice-President as the number of Senators and Representatives sent by the state to Congress. Electors so chosen, 531 in number from 1913 to 1923, form the Electoral College. They meet in their respective states and vote by ballot, a majority being necessary to elect.

Elections to state offices are participated in by all legal voters. In some states a legal voter may be a foreigner who has made only his first declaration of intention to become an American citizen. The man or woman in the United States who is qualified under the state constitution to vote for representatives in the state legislature is qualified to vote for electors of the President and Vice-President, members of the United States House of Representatives, and all state, county and township officers. Elections are said to be *direct,* when participated in by the entire voting population; *national,* when the officers chosen serve the entire country; *state,* when confined to choice of those who administer the affairs of the state; *local,* with respect to limited jurisdiction, as in a county or township; *indirect,* or *representative,* as in the choice by all the voters of electors of the President and Vice-President.

Registration. To secure honesty in elections the names of all legal voters are listed in books at the polling places. Registration is required several days before election, in large cities the last registration day being at least two weeks before election day. The requirements vary in different states, since each state makes its own election laws. In general, however, the voter is required to give his name and place of residence, the length of time he has lived in the precinct, county and state, and to tell the country in which he was born and the year of his birth. If a naturalized citizen he may be required to present his naturalization papers. On election day each voter's name is checked on the polling list when he casts his vote. By this means "repeating," or voting more than once, is made difficult. If a man endeavors to impersonate a voter and secure the privilege of voting when he is not entitled to it, watchers stationed at the polls to detect fraud may "challenge" his right to cast a ballot. Faulty methods of identifying voters are giving way to corruption-preventing devices.

Expense. The expense involved in conducting elections, including the essential items of rental of polling places, printing and distribution of ballots and compensation of election clerks, is borne by the general public out of funds raised by taxation.

In Canada. In Canada, although the Governor-General appoints the Premier, that appointee must in advance have secured election to the Dominion Parliament by majority vote of the people of his district. Elections to Parliament and to local offices in the Dominion are participated in by male voters of twenty-one years of age or over; each province determines the qualifications of voters, as in the states of the American Union. In England the Premier is named by the sovereign, but unless the people endorse the acts of his administration by vote when members of the House of Commons are chosen, he must resign. E.D.F.

Related Subjects. The reader is referred to the following topics in these volumes:

Australian Ballot	Electoral College
Ballot	Naturalization
Citizen	Short Ballot

returns had been sent to Washington, each party advancing strong arguments for the legality of its returns in each state. The contentions arose over the proper election of the Presidential electors. Without the votes of the disputed states, Samuel J. Tilden, the Democratic candidate, lacked only one vote of the necessary majority, while Rutherford B. Hayes, the Republican candidate, needed the twenty votes which were in dispute.

To settle the matter as justly as possible Congress created a commission of fifteen members, composed of five Supreme Court Justices, five United States Senators and five Representatives; this group politically contained seven Democrats and eight Republicans. With the exception of Bradley, one of the Justices, the commission was evenly divided; Bradley cast his vote with the Republicans and decided against the claims of the Democrats that charges of fraudulent voting and manipulation of returns should be investigated. All questions were then decided by a strict party vote, and the election was given to Hayes. The commission's decision was awaited with intense interest throughout the country, and the Democrats were obliged to accept the result, but they have always contended that Tilden and not Hayes was rightfully elected.

Related Subjects. The reader is referred to the following topics in these volumes:

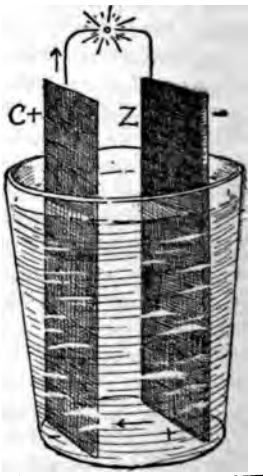
Election	Tilden, Samuel Jones
Electoral College	United States, subtitle *History*
Hayes, Rutherford Birchard	

ELECTRA, *e lek'trah,* the name of several personages in Greek mythology, but referring principally to the daughter of Agamemnon, a king of Argos, and of his wife Clytemnestra, who murdered her husband upon his return from the Trojan War. Different motives have been assigned for this tragedy, one of which was the queen's jealousy of Cassandra, the Trojan prophetess, whom Agamemnon brought home a captive. Electra influenced her brother Orestes to avenge the death of their father by slaying Clytemnestra. Later she became the wife of her cousin Pylades. She is the subject of a number of ancient dramas, notably those of Sophocles and Euripides, and also figures in modern literature.

ELEC'TRICAL FISH, the name applied to various kinds of fishes possessing organs by means of which they can give an electric shock. These organs are composed of cells located in various parts of the body in different species. They use this power in attacking prey or as a weapon of defense, and the effect is the familiar tingling sensation produced by an electric battery. In the electric rays, or torpedoes, the electric organs lie in the head and gill region, and the current passes vertically from the lower to the upper side. After a period of exercise, the power becomes exhausted and is not restored until the fish has had rest and food. The strength of the electric discharge depends on the health, size and vigor of the fish.

Another species of electrical fishes is found in the large rivers of the tropical part of Africa. These, known as the electric catfish, are said to give a shock like that from a Leyden jar. The thick, scaleless electric eel of South America, which sometimes grows to be six feet in length, is the most powerful of the group. Its electric organs, which lie upon the underside of the tail, have sufficient power to stun an animal as large as a horse.

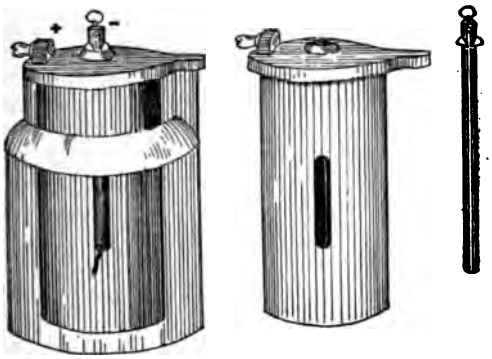
ELEC'TRIC BAT'TERY, a device for producing an electric current by means of chemical action. To make a simple electric battery it is only necessary to place in a glass jar a solution of sal ammoniac, made by dissolving four ounces of sal ammoniac in a quart of water, and to place in this solution a rod of zinc and a rod of carbon. A carbon rod such as is used in an electric arc light may be used. A dilute solution of any of the common acids may be used in place of the sal ammoniac. If an electric bell is connected by copper wires to the carbon and zinc rods of the battery the bell will ring. If the battery is used for some time the zinc will disappear, for it is acted on by the sal ammoniac, forming zinc sulphate, which goes into the solution.



A SIMPLE ELECTRIC BATTERY

The First Battery. The first electric battery was made by Alessandro Volta, an Italian physicist. It consisted of disks of zinc and copper arranged in pairs, and upon each pair of disks a piece of moistened paper. The disks and paper thus formed a pile which

looked somewhat like a round stick. An electric shock could be obtained from the pile of disks. This battery was called *Volta's pile;* it was also sometimes called the *electric stick.*



SAL AMMONIAC BATTERY

Volta also made a battery of zinc and copper strips placed in dilute sulphuric acid; a number of pairs of such strips were used, each pair being in a glass tumbler containing a portion of the acid solution. This battery was called the *crown of cups.*

How a Battery Works. The working of an electric battery can be best understood by a study of a simple cell made like Volta's crown of cups. A strip of zinc and a strip of copper, if placed in contact in air, would each become electrically charged, the zinc having a positive and the copper a negative charge. If the two strips are placed in dilute sulphuric acid, hydrogen from the acid goes to the copper strip. The hydrogen carries a positive charge and gives this charge to the copper; the remaining part of the acid goes to the zinc, giving the zinc a negative charge. Thus by the action of the acid the copper becomes positively charged; the zinc, negatively charged. If the two strips are connected by a conductor of electricity, such as a copper wire, the electric charges flow along the wire, the positive charge flowing from copper to zinc, the negative charge from zinc to copper. The action of the acid continually renews the charges on the copper and the zinc, and a current continues to flow along the wire. (See illustration, "A Simple Electric Battery," page 1980.)

Since the positive charge flows from the copper through the wire, the copper is the *positive electrode,* or the *positive pole,* of the battery. Since the positive charge is carried from the zinc through the liquid to the copper, and since when zinc and copper are placed together in air the zinc becomes positively charged simply by its contact with the copper, the zinc is the positive plate. During the action of the battery the zinc is being continually eaten away by the acid, forming zinc sulphate, which can be obtained as a white powder by evaporating the liquid. It is the action of the acid upon the metal plates which produces the electric current. Chemical energy is therefore changed into electrical energy.

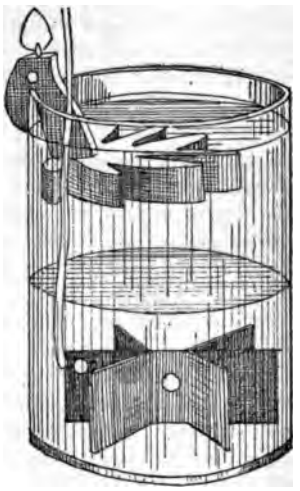
Polarization. The hydrogen which collects on the copper in the simple voltaic cell is necessary to the working of the cell in order to give the copper a positive charge, but if the hydrogen remains on the copper it hinders the flow of the current. This action of the hydrogen is called *polarization.* Polarization is due to the resistance which the hydrogen offers to the passage of the current and to an electromotive force which the hydrogen produces, opposing the main electromotive force of the battery.

A storage battery requires a current from some outside source, changing the plates and the liquid in the cell by electrolysis before it is ready to deliver any considerable amount of electrical energy (see ELECTROLYSIS). Storage batteries are sometimes called *secondary batteries.* Batteries that do not require the action of an electric current upon them, but are ready as soon as the materials are put together to deliver current, are called *primary batteries.* Primary batteries cannot be charged by an electric current as can storage batteries, but can be renewed only by renewing the liquid or the positive plate, or both.

Primary batteries are of two kinds: first, those that do not polarize and therefore will deliver current at constant strength for a long time; second, those that polarize and therefore can deliver current for a short time only, after which the circuit must be open so that the battery can recover. The first kind are called *closed-circuit batteries,* because the circuit can be kept closed for a long time; the second kind are called *open-circuit batteries,* because the circuit must be open most of the time. In most closed-circuit batteries the plates would waste away if the circuit were left open. An open-circuit must be made of such materials that the plates will not waste away when the circuit is open. The most important closed-circuit batteries are the gravity, Daniell and the Edison-Lalande cells.

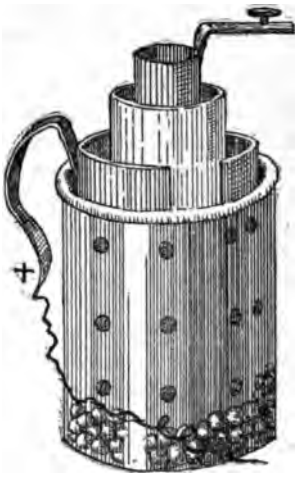
The Gravity Cell. Polarization is prevented in the *gravity cell* by placing the copper in a solution of copper sulphate. The zinc is in a

solution of sulphuric acid. Hydrogen is set free by the action of the acid on the zinc, as in the simple voltaic cell, but when the hydrogen ions reach the copper sulphate they exchange places with copper ions (see Ion). These copper ions go to the copper plate, carrying positive charges. Copper is thus added to the copper plate, making it heavier but in no way interfering with the current. The copper and copper sulphate are placed in the bottom of a glass jar, the zinc and sulphuric acid above the copper sulphate.



GRAVITY CELL

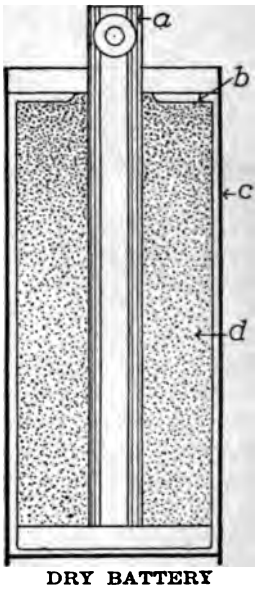
Gravity aids in keeping the liquids separate, the copper sulphate solution being heavier than the sulphuric acid solution. A gravity cell can be set up simply by placing the copper plate in the bottom of the jar and the zinc plate near the top, placing some crystals of copper sulphate in the jar and filling it with water. It is a number of hours after the cell thus set up is placed on a closed circuit before it is ready to give a strong current, but it will then furnish current for a number of weeks. The only attention necessary is to keep the jar filled with water and add copper sulphate crystals from time to time, if the blue color disappears. A small quantity of sulphuric acid is formed by the action of the copper sulphate, which works its way up to the zinc. The action of the cell is then the same as that *described above.*



DANIELL CELL

Other Cells. The so-called *Daniell cell* is made of the same materials as the gravity cell, the liquids being separated by a porous cup. Gravity cells are used in short-distance telegraphy and in block signaling.

In the *Edison-Lalande* cell the negative plate is made of copper oxide. The hydrogen which comes to this plate when the cell is working is disposed of by combining with the oxygen of the copper oxide so that the cell does not polarize. This cell will work on either open- or closed-circuit.



DRY BATTERY

(*a*) Carbon.
(*b*) Porous substance with sal ammoniac.
(*c*) Zinc.
(*d*) Black manganese dioxide.

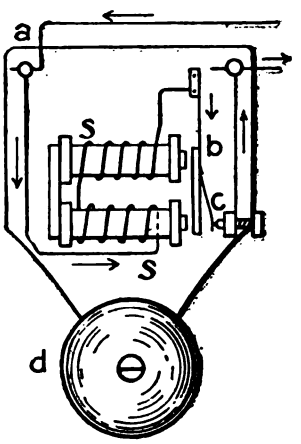
The Bunsen battery is a form of closed-circuit battery formerly used but now replaced by the cells mentioned above. The Grove cell, which preceded the Bunsen cell, consisted of a zinc plate in sulphuric acid and a platinum plate in nitric acid, one of the liquids being in a porous cup. Bunsen and Cooper, working independently, improved this cell for practical purposes by using carbon in place of platinum. The nitric acid prevents polarization, hydrogen combining with some of the oxygen of the acid and forming water instead of collecting on the carbon plate.

LE CLANCHÉ BATTERY

Of open-circuit cells the dry cell and the Le Clanché cell are the most important. The outside of a *dry cell* is a zinc cup which forms the zinc plate of the cell and at the same time contains the other elements of the cell. Within the zinc cup is, first, a porous substance con-

taining a solution of sal ammoniac, next some manganese dioxide in the form of a black powder, and within this a strip of carbon. The sal ammoniac acts on the zinc when the cell is producing a current. The manganese dioxide is a depolarizer which slowly removes the hydrogen from the carbon after the cell has polarized. The Le Clanché cell consists of zinc and carbon plates in a solution of sal ammoniac. E.E.B.

ELECTRIC BELL, a bell that is rung by electric energy. The door bell is the most common illustration of bells of this type. The apparatus consists of an electromagnet *s*, an armature *b*, to which the clapper is attached, a spring that pushes against the screw *c*, and the gong *d*. The battery is usually placed in the basement and the wires connect it with the push button at the door, which is itself connected with the bell. When the button is pushed the circuit is completed and the current flows along the wire *a* and over the coils *ss*, magnetizing the core. The magnet attracts the armature *b* and causes the clapper to strike the gong. This movement removes the spring from contact with the screw and breaks down the circuit, so that the armature is released and moves back to its former position, which brings the spring in contact with the screw and again closes the circuit, so that the bell continues to ring as long as the pressure on the button is maintained. Any number of bells connected with the circuit may be rung by the same push button.

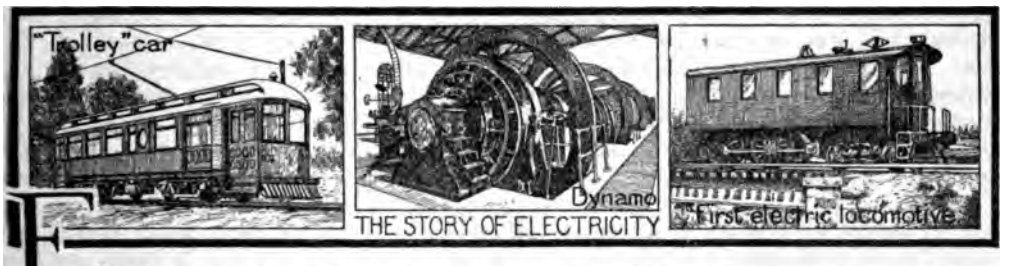


THE ELECTRIC BELL
The various parts are explained in the text.

When electric bells get out of order the trouble is likely to be with the battery, which is weak. If, however, the battery proves to be in good condition one should look at the adjustment of the screw with the spring *c*. Continuous use may jar the screw out of position so that the spring fails to make connection with it. A slight turn of the screw is all that is necessary to set matters right. See ELECTROMAGNET. W.F.B.

Consult White's ***Electric Bells, Alarms and Signaling Systems.***

ELECTRIC HEATING. The production of heat by electricity depends on the fact that materials of high resistance are heated to a higher temperature by an electric current than materials of low resistance. This is shown by the fact that the wires in an electric water heater or an electric toaster become red hot, while the copper wires which conduct the current to the heater are scarcely warmed. Both wires carry the same current, but one having much greater resistance than the other is heated to a much higher temperature. For the same current the quantity of heat produced in a given time is proportional to the resistance; the temperature can be regulated by adjusting the resistance. Electric heaters for street cars and for houses are adjusted to produce sufficient heat to warm the air, but not to so high a temperature as that required for cooking.



ELECTRICITY, *e lek tris' i ti,* the agency which is known to people through a variety of effects commonly called *electrical.* The action of electricity is well understood, but very little is known of its nature. We know well what it *does,* but not what it *is.*

The world has been more than 2,500 years in securing its present knowledge of electricity and electrical effects, and nearly all of our knowledge has come to us within a period of 300 years. Indeed, it can be said that the practical application of electricity to the needs

of mankind is to a remarkable extent a development within the memory of men yet living.

About 700 B.C. a very wise Greek named Thales discovered that a piece of amber rubbed with cloth possessed the power of attracting feathers, pieces of paper and other light bodies to it. Probably other men of that early day noted the same phenomenon, but we only know that Pliny, who died A. D. 114, left the next recorded experiments in the same direction. He knew of the loadstone and likened it to the amber, but did not guess there could be a connection between the two. An Englishman named Gilbert, who died in 1603, gave the world the name *electricity*. Very properly he gave credit to the early Greek who left recorded experiments with amber. The Greek name for *amber* is *electron*, so Dr. Gilbert gave the name electricity to the phenomena which the crude experiments of the day produced. The student who reads in this work something of the lives of Isaac Newton, Volta, Faraday and Davy will learn of the various discoveries and inventions, each of which brought the world one step nearer to present-day electrical knowledge. It would be desirable to learn also that it was Benjamin Franklin who proved to the world that *lightning* and *electricity* are identical in meaning.

Through the later discoveries of Lord Kelvin (Sir William Thomson), Morse, Gray, Bell, Edison, Marconi and others, we begin to believe that the world has reached really the electrical age, although beyond any doubt we are yet on the threshold of electrical discoveries and their applications.

To-day, with electricity we light our houses; illumine our streets; cook food; run trolley cars at sixty miles per hour and heavy passenger trains at nearly as great a speed; lift immense weights; tunnel through solid rock; heal the sick; talk over distances of 3,000 miles and send messages even farther through the air without wires. To secure these great benefits electricity is harnessed and applied to its task through proper machinery by which it is brought to the place where work is to be performed.

To understand something of its wonderful properties we must know that electricity will travel through or along certain substances, but will not traverse other substances. The various electrical effects were formerly classified under the headings of *static*, or *frictional*, electricity, and *current* electricity. A better classification, *in view of the* present-day theory is:

(1) Electrical effects upon nonconductors or very poor conductors of electricity;
(2) Electrical effects upon conductors;
(3) Electrical effects in space.

Conductors and Nonconductors. Any substance, such as copper, through which electricity flows freely is called a good *conductor* of electricity. Any substance through which electricity under ordinary conditions does not flow at all is called a *nonconductor*, or an *insulator*. Glass is practically a nonconductor. A substance through which electricity flows with great difficulty is a poor conductor of electricity. A wet trolley pole is an example; if the wire were to touch the wet pole a weak current of electricity would flow along the pole to the ground. On the other hand, if the pole were dry it would not conduct the electric current.

Electrical Effects upon Nonconductors. Such effects as are noted below are familiar to us in every-day experience. Stroking the fur of a cat causes a crackling sound and the hairs to be attracted by the hand. When a person walks across a carpet on a cold day his body becomes electrically charged and a spark passes if the hand is brought near a metal object such as a gas jet. By rubbing briskly with a flannel cloth a rubber comb or penholder may be easily electrified, so that it will attract light objects such as bits of paper.

When any two objects of different material are rubbed together or merely placed in contact each becomes electrically charged and the charges remain on the objects when they are separated. The two charges thus produced act in opposite ways. This may be shown in the following manner: A small piece of pith such as may be found in a corn stalk is rolled into a ball and suspended by a thread. A rubber penholder or a rod of hard rubber is then electrified by rubbing it with a woolen cloth. If the penholder is then held near the pith ball the ball is first attracted to the penholder, then touches it and takes up part of the electric charge. It then flies away from the penholder. The pith is now repelled by the rubber and attracted by the cloth. The cloth and the rubber each has an electric charge. One charge attracts the charge on the pith ball, and the other repels it. Any electrical charge that is repelled by the charge on the penholder is attracted by the charge on the woolen cloth. An electrical charge of the same kind as the one on the rubber penholder is called a *negative* charge. Any charge of the same kind as the

on the woolen cloth is called a *positive* rge. Whenever any object is electrified it either a positive or a negative charge.

When two unlike charges, a negative and a itive, are separated by an air space, they ract each other. The air resists this action l tries to hold the charges apart. If the raction becomes strong enough to overcome resistance of the air a spark passes, which a discharge through the air. A stroke of ıtning is a series of such discharges in the uds or between a cloud and the earth. A charge through the air is always accom- ıied by heat and light. In such a discharge electricity is for an instant in motion.

Two charges of the same kind repel each ıer. Two pith balls charged from a rubber l and suspended by threads repel each other, ause they have charges of the same kind. e human body may be electrified if one nds on hard rubber or other insulating ma- ial and touches one knob of an electrical chine in operation. The hair then bristles , because all the hairs have the same kind charge and these charges repel each other.

To sum up: Electrical effects upon non- ıductors consist of:

(1) Electrical charges at rest—the charges ıg of two kinds, positive and negative, two ke charges attracting each other so that a ın is produced in the space between them;) Electrical charges in violent motion—that discharge through air or some other poorly ıcting substance, the discharge being ac- anied by heat and light.

ctrical Effects upon Conductors. If an which is a good conductor of electricity s an electric charge, the charge distrib- elf over the entire surface of the object. pper wire receives an electric charge at l the charge flows along the wire until tributed along its entire length. This so quickly that it is practically in- ous. On the other hand, if a glass rod a charge at one end the charge re- that end. An electric charge cannot g a glass rod, but remains on that e rod which first receives it. One glass rod may be charged and the uncharged, but it is impossible to end of a metal rod without the en- oming charged. This is the differ- n conductors and nonconductors.

ic conductor such as a copper wire ositive charge at one end and a rge at the other end, the two ng along the wire in opposite directions tend to neutralize each other. T if the two knobs of an electric machine are nected by a copper wire there is a flow electricity along the wire which is practic instantaneous, and the machine is discharg During the discharge there is a current electricity lasting only a small fraction of second. If the positive and negative charg at the ends of the wire could be renewed a rapidly as the discharge takes place, ther would be a continuous flow of electricity along the wire—a real electric current. This could be done by continuing to turn the handle of the electric machine, but it would not be a practical method; the current produced by the electric machine is too small. There are two practical devices that can be used; they are the electric battery and the dynamo. Either of these when properly connected to the ends of the wire furnishes a continual supply of positive electrification at one end of the wire and negative at the other end. These two kinds of electrification flow along the wire in opposite directions, neutralizing each other.

Definition. An electric current, then, consists of a continuous flow of positive electrification in one direction and negative electrification through the same conductor in the opposite direction. The direction in which the positive charge flows is always taken as the direction of the current.

What Is Electricity? The best answer that can be given to this question is to state clearly what scientists generally believe electricity to be—in other words, to state the modern theory of electricity. It must be remembered that scientists are every year discovering important new facts regarding electricity and that new discoveries may change the theory. With this understanding, we shall proceed to state the modern theory, known as the *electron theory,* as if it were proven so completely that it could never be questioned.

Before the discovery of electrons an atom was supposed to be the smallest particle of matter. Atoms are so small that no microscope makes them visible; they combine to form molecules, and a molecule is therefore larger than an atom. Yet molecules are so small that it takes millions of molecules of air to fill an ordinary thimble. It would take about two and one-half million atoms of mercury to make a row one inch long. If we write the figure 4 followed by twenty-six zeros, we would have approximately the number of molecules of hydrogen that would weigh one grain;

uire twice as many atoms, since o atoms of hydrogen in one mole- atoms are not the smallest objects The electron is so small that it re- ut two thousand electrons to equal gen atom in weight. These extremely ects which we call electrons are the l all the interesting effects which we trical. See ATOM; MOLECULE.

s are not electrically charged under y conditions, but electrons are always ally charged. Every electron, every- and always, carries an electric charge. believed that the electron itself is the ric charge. The curious thing is that y electron carries exactly the same amount lectric charge as every other electron. The ntity of electric charge carried by every ctron is called the *elementary electric charge*. is the smallest electric charge known to exist. When an electron is added to an atom the tom is charged negatively. When an atom which is uncharged has an electron taken away from it the atom becomes positively charged.

How the Current Flows. To understand how an electric current flows through an electrical conductor such as a copper wire, we must picture to the mind the atoms of copper of which the wire is composed, with the inevitable spaces between them. If a flask were made of copper and tightly closed and then placed under very great pressure, water could be made to pass through the sides of the flask before the flask was broken, showing that there are spaces between the atoms of copper through which water can pass. No matter how compact a substance may appear, there are spaces between the atoms of which it is composed. If we imagine the atoms of the copper wire with spaces between them and electrons, much smaller than the atoms, moving freely from atom to atom, we have a picture of what goes on in a copper wire when it carries an electric current. The current in the wire consists of electrons passing from atom to atom throughout the length of the wire somewhat as a water bucket is passed from hand to hand in a bucket brigade. The atoms are set in more rapid vibration by the motion of the electrons. In this manner the current heats the wire, for the vibration of the atoms constitutes heat.

To understand electrical action in space it is necessary to understand what is meant by the ether. Let us use an illustration to make this incandescent electric light bulb report as the air rushes in to fill the space. The air had been pumped out of the bulb until only about one-millionth part of the air which was at first in it remained. Practically all the air was removed, yet something remained in the bulb which was able to transmit the light across the space between the white hot filament and the glass. This something is called the *ether*. Ether fills all space not occupied by material objects. Ether transmits the light of the sun through space; it fills the spaces between the atoms of every substance; it can be caused to vibrate in a certain way by an electrical disturbance, and such vibrations travel through the ether in the form of waves. These waves, if they are short enough, from about 1/30,000 to about 1/50,000 of an inch in length, constitute light, and affect our eyes; if they are longer, our eyes are not affected by them. We call the longer waves in ether electric waves, or, more accurately, electromagnetic waves, and make use of them in wireless telegraphy. A special receiver is made which is sensitive to the longer waves. The human eye is a sensitive receiver for the shorter waves.

Velocity. Electrons by their motion set up waves in the ether. These waves travel through space with a speed of about 186,000 miles per second. The waves set up by the electrons may be of the longer kind used in wireless telegraphy, or they may be of the shorter kind known as light. When an electric current is flowing along a wire such waves are set up all around the wire by the motion of the electrons in the wire, and these waves follow the course of the wire. The waves [illegible] the space around the wire transmit the power of the electric current.

In an insulator, such as glass, the electrons cannot move easily from atom to atom. When they do move through an insulator as through air they do so with great violence. In an insulator the electrons are bound to the atoms; hence, under ordinary conditions no current can flow through an insulator.

When an electric current flows in a coil of wire the coil acts in all respects like a magnet. The current flows around the coil in nearly complete circles. An electric current flowing in a circle has magnetic poles, one face of the circle being a north pole and the other face a south pole. It is believed that in a magnetic substance such as iron the electrons move in circles around the atoms. Each atom with an electron circling about it has a north pole and a south pole.

How Electricity Is Produced. An electric discharge in air, an electric spark, may be produced by an electric machine, an induction coil, or a transformer. In nature such a discharge occurs in lightning. An electric current is produced either by an electric battery or a dynamo. These devices do not in reality produce electricity, for the electricity is present all the time. They merely set the electricity in motion, or produce an electrical tension, or force. Electricity in motion possesses energy; hence these devices produce electrical energy. Energy in some other form is always consumed by these electrical devices to make up for the electrical energy which they give out. For example, a dynamo must always be run by some form of mechanical power such as a steam engine; hence a dynamo uses mechanical energy and gives out electrical energy.

How Electricity Stores Energy. It is commonly believed that electricity can be stored. This is an error. Though electricity itself cannot be stored, it can be used to store energy and this stored energy can be made to produce an electric current. This is accomplished by means of a storage battery.

Electricity as a Cause of Death. With the increasing use of electric currents deaths caused by contact with "live wires" have become increasingly frequent. It is well to know the cause and the means of preventing such accidents.

The human body to a certain extent is protected from electric shock by its high resistance. The resistance of the body is much greater when the skin is dry than when it is moist; therefore, it is safer to handle an electric wire with dry hands than with moist hands. Careful tests have shown that the resistance of the body may be as high as 4,000 ohms when the skin is perfectly dry, and as low as 500 ohms when the skin is thoroughly moistened. The average resistance of the human body is probably about 1,200 ohms.

Alternating current is more dangerous than direct current for the reason that the injurious effect is due chiefly to the shock caused by the changing of the current. With direct current the shock is felt only at the instant of starting and of stopping the current. See CURRENT, ELECTRIC, subheads *Direct Current; Alternating Current.*

The voltage that will destroy life depends on various conditions, but it is fairly well established that no human being can withstand an alternating electromotive force of 1,500 volts of ordinary frequency. Three hundred volts alternating have been known to produce death. It must not be inferred that it is safe to toy with lower voltages than those mentioned. Lower voltages may produce severe burns and other injurious effects.

The cause of death by electric shock is generally believed by medical authorities to be the action of the current on the heart, producing contraction of the fibers of that organ, resulting in stopping the circulation. The nervous system dies as a result of anaemia following the sudden arrest of the circulation of the blood. Death may also be due to asphyxia if the current passes only through the brain and upper portion of the spinal cord, arresting only the action of the nerve centers which control breathing. Death by electricity is not instantaneous, but the experience of persons who have been rendered unconscious by electric shock and have recovered indicates that it is not painful.

Emergency Directions. The treatment in case of severe electric shock consists in keeping the body warm by wrapping it in warm blankets or clothing and applying heat by some means, such as hot water bottles to the feet, and using artificial respiration as in a case of drowning. If the patient when found is still touching the wire, it is not safe to touch his body or the wire with the bare hands. He should be pulled away from the wire by the clothing or the wire may be torn from his grasp with a dry stick. With a thick leather glove on the hand it is safe to take hold of the body or the wire, if the glove is dry. E.E.B.

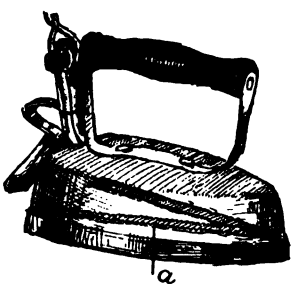
Uses of Electricity

Electricity has become our willing and ready servant. Within the last half century the discoveries of new powers of this remarkable force and the invention of machines for utilizing these powers have constituted some of the greatest wonders in the world of science. The first important application of electricity to practical service was in the operation of the telegraph in 1844 (see TELEGRAPH). The invention of other devices was slow until about 1880, but since that time these inventions have increased rapidly, both in number and variety. The uses of electricity are so many that it is nearly impossible to enumerate them. So

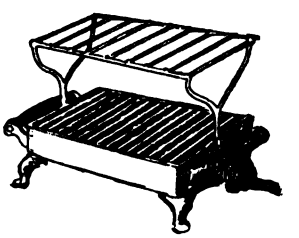
gradually has this subtle force extended its sway over civilization that there is scarcely an industry that does not depend upon electricity or is not modified by it.

The larger uses of electricity are described in special articles referred to below. It is the purpose of this article to call attention to a number of minor uses that are not so well known, but which are practically within the reach of all.

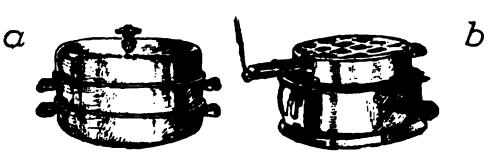
Household Economy. The application of electric energy to the operation of machinery enables the housewife to change what was formerly drudgery into a delightful occupation. The electric motor, which can be installed at slight expense and operated by attaching it to an electric light socket, runs the sewing machine, the washing machine, wringer and the vacuum cleaner. The application of electric energy to the production of heat (see ELECTRIC HEATING) and the invention of innumerable devices for household use make housekeeping a pleasure and enable the wife and mother to devote time and energy saved by these devices to recreation and culture. First among these conveniences may be mentioned the electric iron, which is heated by the passage of the current over the resistance coil, *a*. Attach the cord to the lamp socket and in a few minutes the iron is ready for use. By means of the electric toaster, of which



ELECTRIC IRON
The coil *a* shows how iron is heated.

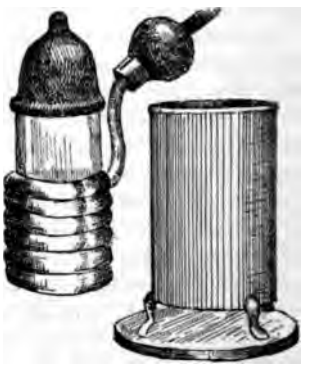


ELECTRIC TOASTER



AN OVENETTE

there are numerous types, the toast for breakfast *can be made* at the table and served hot. The toaster shown here can be used for heating other articles, as well. The heating coils are in the box and are shown by the shading below the wires. The ovenette is a small electric oven. The part *a*, shown in the illustration, sets over *b*, which contains the heating coils. This little device is as efficient for its purpose as the large oven of a gas or coal range. But perhaps the most unique device is the nursery milk warmer, shown herewith. By setting the bottle in the coil the milk is soon warmed at any hour of the day or night. To these devices add electric coffee pots, percolators, stoves and grills, and it is readily seen that the electric current can be made to perform a great variety of household duties.



ELECTRIC MILK WARMER

Electricity on the Farm. Wherever the farmer can procure electric energy he can use it to the saving of time and expense, by the use of the electric motor to run the washing machine and wringer, the churn and the sewing machine for the mistress of the home; by using the same motor to turn his grindstone, run his feed grinder and any other machine about the buildings. Another and equally valuable use of the electric current on the farm is for the production of electric light. The farmer may obtain his current from some electric company by running wires from the nearest point on their cables to his premises, or, if he has a water power site on his land, by installing a private dynamo. However, the former plan is the less expensive.

Electricity and War. The War of the Nations led to uses of electricity never before attempted. All aeroplanes depend upon electricity for ignition. Electric searchlights and range finders are controlling factors in artillery fire. The largest guns are often aimed by directions given by officers far removed from the gunners, and they are fired by the use of the electric current instead of the old method of percussion. Without the storage battery to supply power the submarine would be unable to operate. Without the use of electricity

modern methods of warfare would have to be almost entirely changed.

Electricity in Medicine. The beneficial effects of electricity in stimulating the nerve cells and thus securing greater activity in the various organs and tissues of the body has long been known, but the use of electric energy in medicine has been extended far beyond this limit. In surgery it is used to destroy tumors and diseased tissue, for removing birthmarks and superfluous hair and for cauterizing wounds. Besides these uses there are others peculiar to the X-ray, which are described under the title ROENTGEN RAYS. W.F.R.

Consult Burns's *Electric Motor;* Burns's *Alternating Currents Simplified;* Durgin's *Electricity, Its History and Development;* Campbell's *Principles of Electricity;* Millikan's *Practical Lessons in Electricity.*

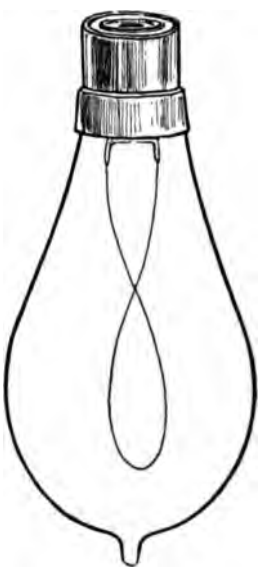
Related Subjects. The above article with its numerous subtitles does not much more than lay the foundation for the treatment given to electricity in these volumes. The following articles will be of interest in this connection:

Armature	Electroscope
Cathode Rays	Electrotyping
Crookes Tubes	Faraday, Michael
Current	Galvanic Battery
Davy, Sir Humphry	Galvanism
Dielectric	Galvanometer
Dynamo	Induction, Electric
Edison, Thomas A.	Induction Coil
Electric Battery	Insulator
Electric Bell	Kilowatt
Electric Heating	Lightning
Electric Light	Locomotive (subhead
Electric Machine	*Electric Locomotive*)
Electric Meter	Magnet and Magnetism
Electric Motor	Marconi, Guglielmo
Electric Railway	Ohm
Electric Welding	Roentgen Rays
Electrochemistry	Storage Battery
Electrocution	Telegraph
Electrode	Telephone
Electrolysis	Thermoelectricity
Electromagnet	Vacuum Cleaner
Electromagnetic Theory	Volt
of Light	Volta, Alessandro
Electromagnetism	Voltaic Pile
Electrometer	Watt
Electromotive Force	Wireless Telegraph
Electroplating	

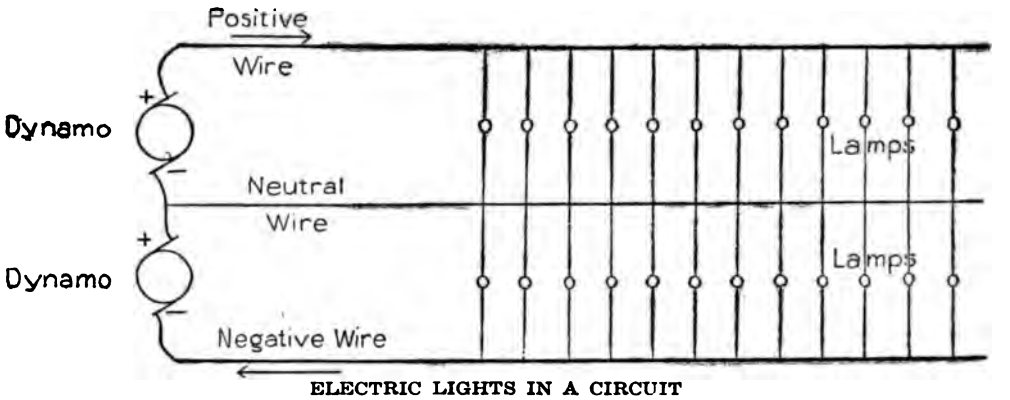
ELECTRIC, *e lek' trik,* **LIGHT,** a light produced by an electric current, a development of the latter part of the nineteenth century. Few people realize the extent to which electric light has changed the face of the earth, within the memory of fully one-third of the people yet living in the highly-civilized nations. Early in the nineteenth century men carried lanterns to find their way along city streets at night; later, illuminating gas was hailed as a great improvement, and prophets were dreaming of the time when a city might be as light by night as by day.

The electric machine produces a flash of light which lasts only a fraction of a second. This fact led inventors in the first decade of the nineteenth century to seek a means of producing a steady electric light. The earliest attempt that gave even a faint promise of success was that of Sir Humphry Davy, who with a battery of hundreds of cells produced an electric arc; the cost, however, was so great that this method of lighting was not thought practical. This was in 1813. In 1858 a light sufficiently strong for lighthouses was produced by means of magneto-electric generators. With the invention of the dynamo of Werner von Siemens and Zenobe Theophile Gramme, in 1866 to 1868, the system of arc lighting was greatly improved. The light could be used where a single powerful light was needed, as in a lighthouse or on city streets, but it was not suitable for house lighting. The invention of a practical incandescent light by Thomas A. Edison in 1878-1879 made it possible for the first time to have a large number of small electric lights suitable for use in houses.

The Incandescent Light. The ordinary incandescent light has a strange history. Soon after the discovery of the electric battery it was found that an electric current flowing through a wire will heat the wire, and if the current is strong enough the wire will become white hot and give out light. Here, then, was a means of producing electric light, but what kind of wire should be used? Platinum has high resistance and is easily heated to a white heat, but the platinum lamp when tried was found to be too expensive, both to manufacture and to operate. Carbon has high resistance and also is easily brought to a white heat, but a carbon filament made white hot in air



CARBON LAMP
Now largely abandoned in favor of more powerful lights at less cost.



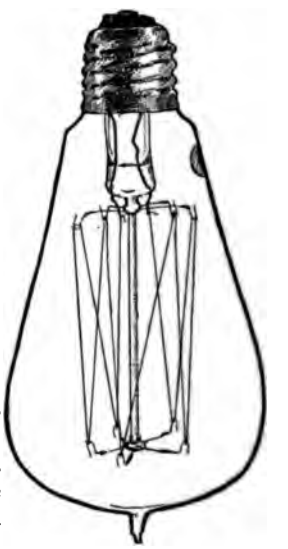
ELECTRIC LIGHTS IN A CIRCUIT
Multiple connection of incandescent lamps, three-wire system.

would last only a fraction of a second, for carbon burns in air. If carbon were used it would have to be enclosed in a vacuum, so that it could not burn.

The Carbon Lamp. It was Edison who in 1879 devised the first successful carbon filament lamp. This lamp consisted of a thread of carbon in a sealed glass globe from which the air had been pumped until only about a millionth part of the original air remained. Edison at first tried to make the thread of carbon by charring cotton thread, paper, wood —everything, in fact, that could be adapted to the purpose. Bamboo fiber was among the substances tried. It proved superior to the other materials and he began a search for the best form of bamboo. Men were sent to all parts of the world where bamboo grows and at the risk of their lives secured specimens of every known variety. The search cost about $100,000, and resulted in the adoption of a Japanese variety.

For a number of years the carbonized fiber of the bamboo was used and then replaced by the "squirted" filament. Such a filament is made by "squirting" a solution of cellulose through glass jets into alcohol. The alcohol hardens, that is, it coagulates, the cellulose, and this is afterwards carbonized by heat. The ends of the carbon filament are soldered to two platinum wires which are sealed into the glass and make connection with the electric current.

The Tungsten Lamp. This is in some respects superior to the carbon lamp. The tungsten filament when prepared by the "squirting" process was so fragile that the lamp could not be used where it would be jarred; but since the discovery of a wire-drawing process of preparing the filament tungsten lamps have been made of such durability as to make them suitable for use even in street cars. The great advantage of the tungsten lamp is its high efficiency. A tungsten lamp gives out about one candle power of light for every one and one-fourth watts of electrical power which it consumes, while a carbon filament lamp yields only about one candle power for every three and one-half watts. For the same amount of light, therefore, the cost is nearly three times as much when using the carbon lamp as when using the tungsten lamp.



TUNGSTEN LAMP
A lamp of high candle-power, rapidly supplanting the carbon lamp. It is popularly known as the "Mazda," its trade name.

The Nitrogen Lamp. A recent invention is an incandescent lamp filled with nitrogen. This is the most efficient lamp yet devised, for it furnishes more light for a given amount of electrical energy than any other electric light. A 2,000-candle-power lamp requires only 1,000 watts or only one-half a watt per candle power, while the ordinary tungsten lamp requires about one and a quarter watts per candle power. In the nitrogen lamp the filament, which is of tungsten, is heated to a white heat in the nitrogen which fills the bulb; but the filament cannot burn, for nitrogen is an inert gas, that is, it will not combine with other substances.

Lighting Circuits. Incandescent lamps are usually connected in multiple, with such an arrangement that each lamp may be turned on and off independently of the others. Low voltage lamps may be used on high voltage circuits by connecting them in series. For example: Suppose the voltage of a trolley line is 550 volts. The same lamps may be used in the street car as on a 110-volt circuit, but in the street car it is necessary to connect five 110-volt lamps in series. When this group of five lamps is connected to a 550-volt circuit there is a pressure of 110 volts at the terminals of each lamp. Low-voltage lamps, both carbon and tungsten, are made for use with batteries. The most extensive use of such lamps is for automobile lighting.

A common form of wiring lighting circuits is the three-wire system. Two of these wires, commonly called the *live wires,* form a 220-volt circuit. The third wire is neutral. The difference of potential between either of the live wires and the neutral wire is 110 volts.

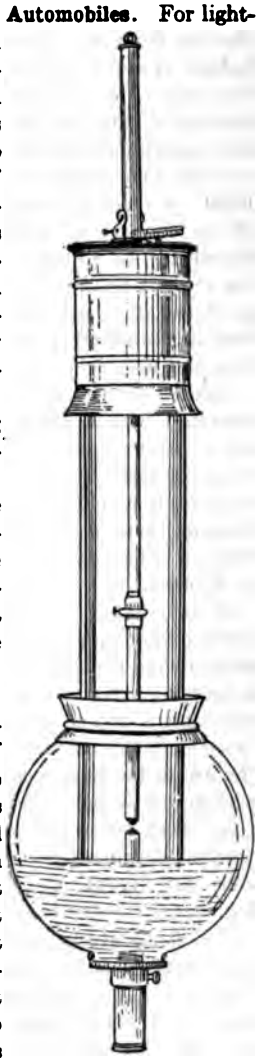
The Nernst Lamp. This lamp depends on the strange fact that many insulating substances become conductors of electricity at high temperatures. Even glass, which is one of the best insulators, when heated to a red heat becomes a conductor, and a current may then be passed through it sufficiently strong to cause it to incandesce, that is, to become white hot; and the glass may even be melted by the heat developed in it by the electric current.

The essential part of the Nernst lamp is the glower, a small rod of rare earths mixed with a binding material. This rod is an insulator at ordinary temperatures; therefore it must be heated to make it a conductor. The heater is a coil of platinum wire mounted close to the glower. When the current is turned on, the platinum wire quickly becomes white hot and heats the glower. As soon as the glower is heated sufficiently to conduct the current, the current passes through it and it instantly glows with an intense white light. The platinum coil is then automatically cut out of the circuit. The glower lights at a heat of about 1,740° Fahrenheit.

Mercury Vapor Lamp. The mercury vapor lamp gives out a bluish-white light containing almost no red rays. This light is good for photographic purposes, since the blue rays which it contains readily act on the photographic plate. In such a light a red rose appears almost black. The face of a person appears almost ghastly pale, the lips purple as if from asphyxiation. This lamp is a glass vacuum tube, usually three feet or more in length. The cathode is mercury; the anode, iron. To light the tube it must be placed in a horizontal position until the mercury extends the entire length of the tube and completes the electric circuit; then the tube is tilted so that the mercury drops back to one end. The electric current vaporizes a portion of the mercury and continues to flow, the mercury vapor being a good electrical conductor. The current causes the mercury vapor which now fills the tube to glow with a bright bluish-white light.

Lighting Trains and Automobiles. For lighting trains on a steam railroad, a combination of dynamo and storage battery is used. A dynamo geared to an axle of the car furnishes current for the lights when the train is running. When the train stops a storage battery is automatically switched into the circuit.

For electric lighting of automobiles a similar system on a small scale is used. The dynamo not only furnishes current for the lamps when the automobile is running, but charges the storage battery.

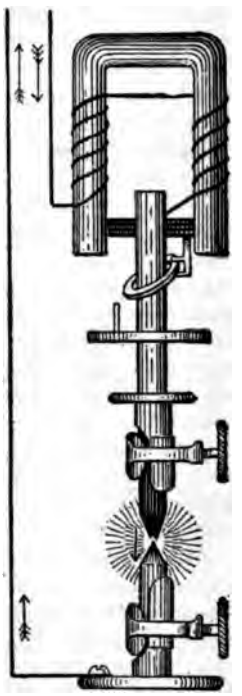


ARC LIGHT
Enclosed.

The Arc Light. When two rods of carbon are made part of an electric circuit so that a current flows through them, and the carbons are then separated by a short distance, the current continues to flow; but to flow from one carbon to the other it must cross the gap between them. This gap, if in air, offers very great resistance to the current. On account of this resistance intense heat is produced—so intense that it

vaporizes the carbon. This carbon vapor crosses the gap in a bluish stream curved like an arc of a circle, hence the term *electric arc*. The stream of carbon vapor is curved by the magnetic action of the current which it carries.

The heat of the electric arc is so intense that it is used for the electric furnace. If the arc is produced by a direct current, the carbon vapor flows from the positive to the negative carbon, and the tip of the positive carbon becomes hollow on account of the carbon flowing from it. This hollow space is called the "crater," and at the bottom of this crater is the highest temperature of the arc—nearly 6,300° Fahrenheit. When the arc is produced by an alternating current no crater is produced, for each carbon is alternately positive and negative.



ARC LIGHT
Showing parts.

Every arc lamp is provided with a mechanism which automatically "feeds" the carbons as they burn out, keeping them at a constant distance from each other.

A searchlight is an electric arc with a reflector for sending the beam in any desired direction. For such a light a focusing lamp is required. This lamp has a mechanism which feeds the positive carbon twice as fast as the negative carbon. This keeps the arc in the same position, since the positive carbon burns out twice as fast as the negative. Such lamps are used also for lighthouses, theater illumination, scenic effects, stereopticons, moving picture machines, photo-engraving, and as electric headlights in locomotives.

The flame arc is produced by means of carbons having cores which are impregnated with certain metallic salts which produce a yellow flame as the arc burns. The flame arc gives a more brilliant light, with greater penetrating power, than the ordinary arc.

The enclosed arc is an arc almost completely enclosed in a glass globe. In such a lamp the carbons are consumed very slowly because of the small amount of air admitted. The light, although less intense than would be yielded by the same electric power in open air, is more uniformly distributed.

Electric current can be used to light cities hundreds of miles from the source of the current. The current generated at Niagara Falls lights cities 250 miles away. The actual cost of electric lighting to the householder is slightly more than the cost of gas lighting for an equal amount of light, but the electric light more than saves its extra cost by its cleanliness. Walls and furniture require less attention in an electrically-lighted room than in one lighted by gas.

Dangers from electric wiring have been greatly exaggerated. When the wires are run in conduits, as they should be, there is absolutely no danger. Fires may result under very exceptional conditions when the wiring is "exposed," that is, supported on porcelain knobs instead of being run in metal conduits. The conditions necessary to cause a fire are that the insulation must be worn off both wires, and the bare wires must come in contact with each other and at the same time in contact with dry wood or some other combustible material. Even then the chances are that a fuse would be blown in the "cut-out box" and a fire prevented. E.E.B.

The measurement of electrical energy used in lighting is explained under ELECTRIC METER. Consult Franklin's *Electric Lighting*, and *Standard Handbook for Electrical Engineers;* Bell's *Art of Illumination;* Parker's American *Handbook for Electrical Engineers.*

Related Subjects. The reader is referred to the following titles in these volumes, in addition to those named above:

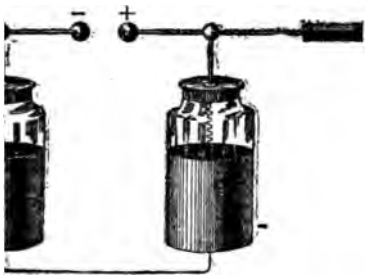
Current	Insulator
Davy, Sir Humphry	Tungsten
Electric Battery	

ELECTRIC MACHINE, a machine which produces charges of positive and negative electrification by friction or induction.

The first electric machine was made by Otto von Guericke of Magdeburg, about 1663. It consisted of a globe of sulphur on an axis which could be turned by hand. When the dry hands were held against the rotating globe electric charges were produced by the friction (see ELECTRICITY). Revolving glass globes and glass plates rubbed by leather pads were used later. Only a small charge is produced by a single rotation of the glass plate, but the machine is so arranged that these charges accumulate; after many rotations of the plate

harges have been added together very strong charges on the knobs hine. This principle, namely, the n of small charges to produce a ge, is true of all electric machines, electrification is produced by fric- induction.

ction electric machine is more ef- the friction machine. The former lay in physics laboratories and in



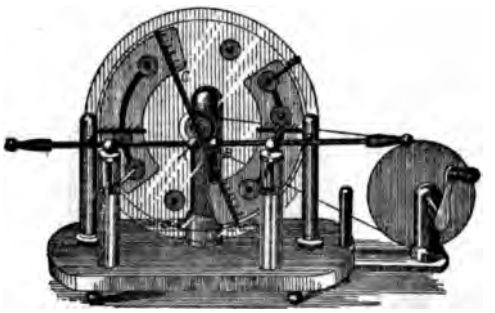
LEYDEN JARS

; it is a device for charging with arges two knobs connected with coatings of two Leyden jars (see). The outer coatings of the jars ed together, the outer coating of ving a charge of the kind opposite ts inner coating. The distribution ges is shown in the illustration. rges are continuously added to the harges on the outer coatings of the correspondingly increased. When on between the two charges equals own strength of the air a spark een the knobs. If the knobs are o an X-ray or a Geissler tube there ious discharge through the tube.

ion Machine. The knobs *a* and *b* ed to two collecting combs, as e second illustration. These combs ric charges from metal studs on ss or vulcanite disk. These studs by induction at the instant they rushes of the rod *c*. Charges are rod *c* by the charges on the sheets nd varnished paper on the back disk. The studs give up part of s to the sheets of tinfoil, so the the tinfoil as well as on the knobs d by the rotation of the disk.

gy of the electric charges is pro- e work done in rotating the disk. rrect to say that electricity is pro- he action of the machine. There electricity in an uncharged metal rod as in the same rod with equal positive and negative charges at its ends; the machine merely produces a tension or strain in the electricity which already existed. A body in which this electrical force or strain exists is electrically charged.

Experiments with the Machine. If a person stands on a stool the legs of which rest on glass or rubber and touches one knob of the machine while it is being turned, his body becomes electrically charged. His hair, if dry, will stand on end. If another person holds his hand near the hair of the person who is receiving the charge the hair will turn toward his hand, because of electrical attraction. The person on the stool has no unpleasant sensation, no matter how strong the charge may be, for there is no sensation until a discharge takes place. If the person on the stool touches the hand of another person a spark passes between their hands, and each experiences a sharp prickling sensation. A number of persons, holding hands, may form a line; let the machine be turned until a small charge collects on the knobs and then the two at the



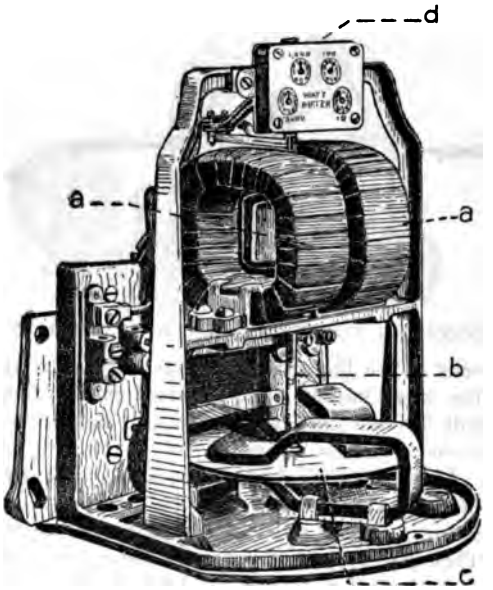
COMMON FORM OF ELECTRIC MACHINE

ends of the line may touch the two knobs at the same instant. Every person in the line will feel the discharge, but it will not be intense enough to be painful.

An experiment which is beautiful, especially in a darkened room, may be performed as follows: Draw a design in outline on paper. Then lay a plate of glass on the paper and paste bits of tinfoil or tea lead on the glass, following the outline on the paper beneath and leaving spaces of about one-eighth inch between the bits of tinfoil. Then attach two wires to the knobs of the electric machine and let the ends of the wires touch the pieces of tinfoil at the ends of the design. When the machine is turned sparks pass across all the spaces between the bits of tinfoil, illuminating the design. E.R.B.

ELECTRIC ME'TER, a machine used to measure the quantity of electric energy consumed. Electric service companies charge for their service according to the readings of the electric meters in the premises of their customers. Since the kilowatt-hour is the unit of electrical energy, the meter measures kilowatt-hours or watt-hours, and for this reason it is sometimes called a watt-hour meter. See WATT; KILOWATT.

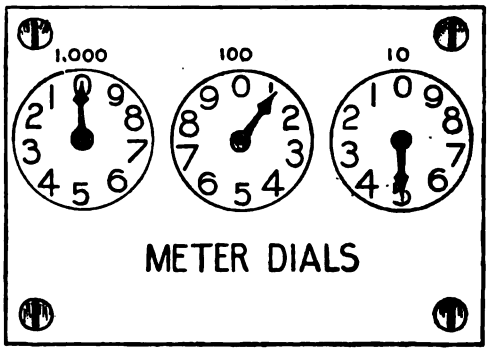
Description of the Meter. The principal parts of the watt-hour meter are the field coils *a a*, the vertical shaft *b*, to the lower end of which is attached a horizontal circular disk *c*, and the dials *d*. These are shown in the first illustration. The field coils are wound with coarse wire and are connected with the electric circuit in series. They are without cores and they carry the whole volume of the current. The armature is mounted on the shaft *b* and is wound with very fine wire, which forms a shunt circuit between the two wires of the main circuit and carries a current of small volume, but one that represents the full pressure by which the branches of the current



MECHANISM OF A METER
Explanation of the figure appears in the text.

are driven. The difference in pressure in the field coils and the armature causes the armature to revolve. The vertical shaft is connected with a system of clock work which moves the needles over dials, as described in the paragraph below.

Reading a Meter. An electric meter usually has either three or four pointers on the dial. Each pointer moves over a circular scale having ten spaces. The pointer on the right moves over one space while one kilowatt-hour is being used. When this pointer makes one complete revolution ten kilowatt-hours have been used. The second pointer makes one



A SMALL METER
The reading indicates fifteen kilowatt-hours.

revolution while the first makes ten revolutions, so that each space of the second scale indicates ten kilowatt-hours and one complete revolution of the second pointer indicates one hundred kilowatt-hours. Each space of the third scale indicates a hundred kilowatt-hours and each space of the fourth scale 1,000. In the illustration the number above the circular scale is the amount recorded by one complete revolution of the pointer.

To read a meter, note the number of complete spaces or divisions of the scale passed over by each pointer and write them down in order, beginning at the left. The result will be the number of kilowatt-hours. If a pointer is near a mark of the scale consult the pointer to the right to find out whether the mark has been passed or not. Unless the pointer to the right has reached or passed the zero, or, in other words, has completed a revolution, the other has not completed the division which it appears to have completed. See the second illustration for example of meter reading.

ELECTRIC MOTOR, *mo'ter.* By attaching a dynamo to a steam engine or a water wheel and applying the necessary power, the power of the steam or water is transformed into electric energy. This energy can be carried long distances by wires and connected to another dynamo, transmitting to it a motive power that may be used in the operation of machinery. An electric motor is a dynamo deriving its power from an electric current. It may be called a dynamo reversed.

Underlying Principle. The electric motor depends for its operation upon the power of an electric current to produce motion; wherever there is an electric current there is magnetic action all around the conductor along which the current flows. This may be illustrated by a simple experiment (Fig. 1). Procure a wine glass or small tumbler, a small bar magnet, a small quantity of mercury (quicksilver), an electric cell and several pieces of wire. Small copper wire for the battery connections is the best. The other wire should be large and strong. Assemble the apparatus as shown in the cut. Fasten the magnet (*a*) into the glass (*b*) with glue so it will remain in an upright position. Pour the mercury (*c*) into the glass. Attach the wire (*e*) to the standard (*d*) so that it will swing freely, and make it long enough to touch the surface of the mercury. When the wires (*f*, *f*) are attached so as to form a circuit with the battery, the wire (*e*) will rotate around the magnet. If the direction of the current is reversed, the wire will rotate in the opposite direction, the motion being caused by the magnetic force which is mutual between the magnet and the wire. This simple experiment, first performed by Faraday, pointed the way to the invention of the electric motor (see FARADAY, MICHAEL). If instead of the bar magnet and the straight wire we use a horseshoe magnet and place a coil of wire between the poles, as shown in Fig. 2, we have a simple electric motor. Since the causes of the motion described above are fully explained in the articles ELECTROMAGNET and ELECTROMAGNETISM, the reader is referred to those articles for this explanation.

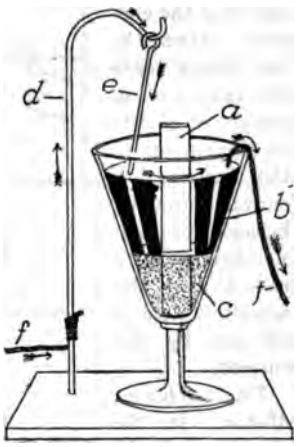


FIGURE 1
Explanation of this simplest form of electric motor is given in the text.

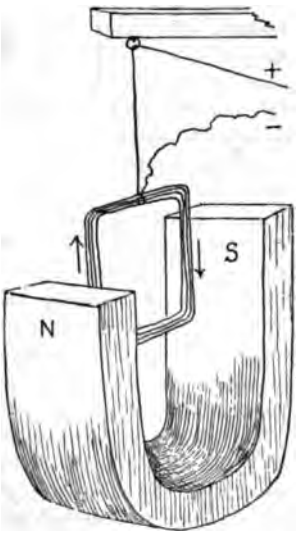


FIGURE 2

Operation. The necessary parts of an electric motor are the same as those of a dynamo (which see); these are the field magnets, the armature and the commutator. The current conveyed to the motor induces magnetism in the armature and also excites the magnetic field. The armature is so magnetized that the line of its poles is at right angles to that in the magnetic field produced by the field magnets. The attraction of opposite poles causes the armature to rotate to such a position as will place the line connecting its poles parallel to that of the magnetic field, but before it reaches this position the connections of two windings of the armature are automatically charged by the commutators and the current is reversed, shifting the polarity of the armature back to its original position, and the armature, still impelled to adjust itself to the new conditions, continues to rotate. This reversal of the current of the commutator is shown in Fig. 3 *a* and Fig. 3 *b*.

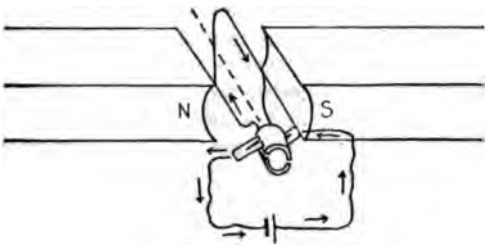


FIGURE 3, *a*
The coil cannot turn farther until direction is changed.

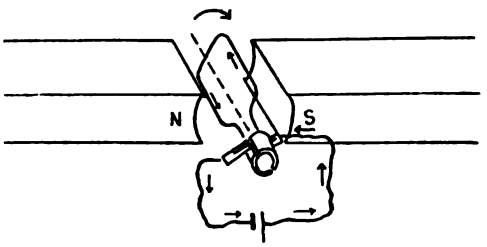


FIGURE 3, *b*
The current has changed direction in the coil, and the coil continues to turn.

For the sake of simplicity the motor described is of the ring-armature pattern, in which the armature consists of a soft iron

ring, wound with insulated wire; but these armatures are no longer used for commercial purposes, because the magnetic field acts only on the outer parts of each coil. The inner part is of no use in producing motion, and the ring armature requires about twice the length

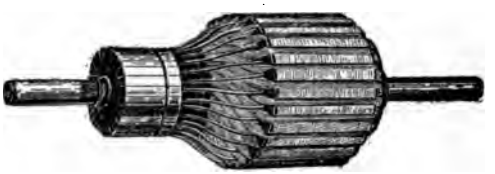


FIGURE 4
A drum armature.

of wire and therefore offers twice the resistance of the drum armature in general use, as shown in Fig. 4.

The simplest electric motor has an armature with two poles and a two-part commutator. But such a motor is not made for practical use. Some motors have four poles, and large ones have more; to all these the name *multipolar* is given.

Counter Currents. When the armature moves it causes a current that flows in the opposite direction and becomes an opposing force, which weakens the current causing the motion. The greater the speed of the armature, the greater will be this counter force, but at the same time that this counter force is increased by the speed of the armature, the direct electromotive force is proportionally increased so that there is little or no loss of power from this source. There are, however, two direct causes of loss of power. These are friction and the resistance offered by the conductor along which the current flows. No machine can transmit all the power it receives, for some of it must be used in the operation of the motor itself. Every conductor offers more or less resistance to the current it carries, so considerable power is lost in transit. For these reasons electric motors are smaller than the dynamos supplying them with power. See ELECTROMOTIVE FORCE.

Types of Motors. Various types of electric motors of all sizes are on the market, but all have grown out of the fundamental types first invented. Chief among these are the following:

The Series Motor. This is the simplest type of motor. The current passes through both the armature and the field coils. Its course can be traced by the arrows in Fig. 5. The power of [redacted]or depends upon the power of the [redacted]urrent and upon the strength of [redacted]ce an increase of current increases both the armature current and the strength of the field, a slight increase in current produces a large increase of power. The rule for the series motor is: For light loads the power increases as the square of the current strength. For heavy loads the increase in power is nearly in proportion to the increase of current strength, because the magnets become saturated and the armature alone is affected by the current.

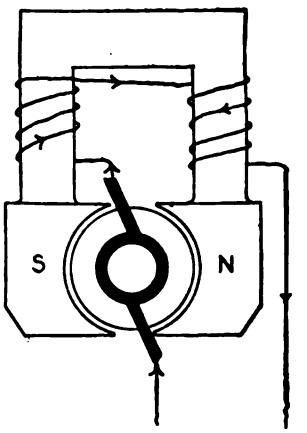


FIGURE 5
A series-wound motor.

The Shunt Motor. In the shunt motor the current is divided, one part going through the armature and the other through the field coils. The direction of each branch is shown in Fig. 6. The coils of the field magnets consist of many turns of fine insulated wire. Since the magnetizing effect of a current depends upon both its strength and the number of times it flows around an iron coil, the field is much stronger in the shunt-wound than in the series-wound motor. Because of the length of wire in the field coils they have such high power of resistance that changes of load which strongly affect the armature produce comparatively slight effects upon the field; consequently the shunt motor runs with a more uniform speed than the series motor.

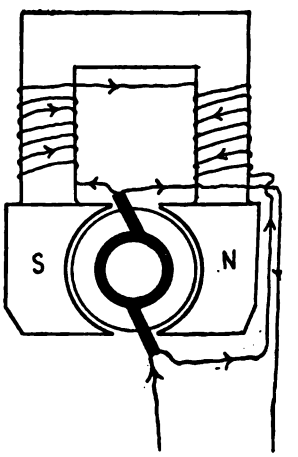


FIGURE 6
A shunt-wound motor.

The shunt motor is used where uniformity of speed is required, as in the operation of machines. The series motor is used where great power is required in starting and considerable variation of speed is necessary, as on electric cars.

The Compound Motor. The compound motor is a combination of the series and the shunt types. One branch of the current goes around the field coils, as in the shunt motor. The other branch, having a low resistance, goes around the field and through the armature coils. The current flows in the same direction in the two field coils. The division of the current and windings are shown in Fig. 7. Compound motors are used in rolling mills and other places where the load may be suddenly increased.

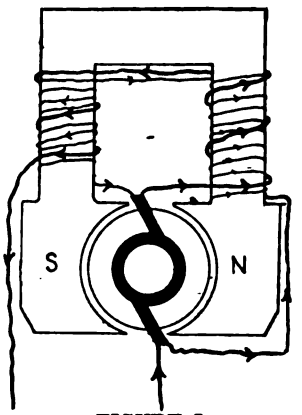


FIGURE 7
A compound-wound motor.

Uses. The electric motor is used for almost every purpose which requires power for operating machinery. Since electric power can be carried hundreds of miles with but slight loss, the electric motor makes available hundreds of thousands of horse power from water power sites; before its invention this immense power was useless because of its inaccessibility. The power generated at Niagara, for instance, is used to operate street cars more than two hundred miles away, and the street cars in San Francisco are operated by power generated by mountain streams over a hundred miles distant. Many small towns have become thriving manufacturing centers because they have obtained electric power from a distance. Electric motors are constructed in all sizes, from those that operate a sewing machine to the locomotive that moves the heaviest trains.

The application of the small motor which can obtain its power by connecting it with an electric light fixture to operate the churn, the washing machine and wringer, the vacuum cleaner and other household machines, has conferred a great blessing on many homes in both city and country. In nearly all modern factories each machine is operated by its own motor. W.F.R.

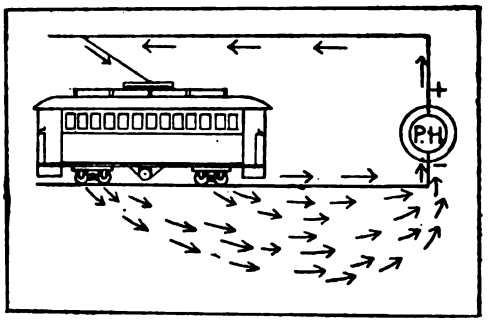
ELECTRIC RAILWAY, a railway on which cars or trains are propelled by electricity. Before the nineteenth century had run half its course, the idea of driving trains by electric power had begun to interest inventive minds. Thomas Davenport, a blacksmith of Brandon, Vt., attempted to build an electric railway as early as 1835. Three years later a Scotchman living in Aberdeen invented an electric locomotive. These first experiments had little practical significance, because experts had come to realize that so long as current had to be generated in batteries service on a large scale would be too expensive. It was the invention of the dynamo, furnishing a current of high voltage at a considerably less cost, that encouraged inventors to push their experiments. See DYNAMO.

Investigations were conducted both in Europe and in America. A working railway was shown at the Berlin exposition of 1879. In 1883 Thomas A. Edison and Stephen D. Field exhibited an electric locomotive at Chicago. The first overhead trolley line was built at Kansas City the following year, and four years later the street railway system of Richmond, Va., was equipped with electric power. The period of rapid expansion which followed may be dated from the successful experiments at Richmond. In city after city electric cars have taken the place of horse-cars on the street railways, until now the latter are rarely seen. Cable-cars, too, have largely been superseded. Improvements in the type of motor and the construction of cars went rapidly forward, and as they did so the electric car spread from the city to the country. Interurban lines, forming a network across the country, are everywhere bringing the town and the village nearer to the city.

As electric locomotives of increased efficiency are designed they are more and more substituted for steam locomotives. The first changes from steam to electricity were made to eliminate the smoke and dirt of coal on elevated railways, in tunnels and subways and at terminals in large cities. All trains entering New York City are now operated entirely by electricity. But, except in mountain regions where water power is plentiful, electricity has not been found more economical than steam. It is true that electric locomotives may be operated more cheaply, but interest on the enormous cost of installing the electrical equipment is usually greater than the saving. Perhaps the greatest step in the history of electric railroading was the introduction in 1916 of electric engines on 440 miles of the main line of the Chicago, Milwaukee & Saint Paul Railway in the mountains of Idaho and Montana. These engines are 112 ft. 8 in. long and haul passenger and freight trains across the continental

divide at greater speed and less cost than is possible with any other type of locomotive. The force of the train on a descending grade is utilized to generate thirty per cent of the power taken from the trolleys in climbing. See LOCOMOTIVE, subhead *Electric Locomotive.*

Trolley Lines. In the overhead trolley lines, so familiar in city streets, the current is generated in a central power house, and passes along heavy copper wires above the tracks. In the usual type of car it is carried through a



THE ELECTRIC CAR

The illustration shows how the electric current reaches a trolley car and returns to the power house (P. H.) through the rails and the earth.

small trolley wheel down the trolley pole conductor to the motors under the car, and returns to the power house along the tracks. The trolley wires may be suspended between poles set on either side of the street, or may be attached to an arm of a single pole placed between the tracks.

Conduit System. In New York and Washington and some European cities, where overhead wires are not permitted, the current is supplied to cars through conductor rails, sunk in slots similar to the cable-slots once used for grip-cars. An arm extends from the motors through the slot and takes up the current by means of rubbing blocks, which press against the charged rail.

Third-Rail System. Wherever it is practicable, the third-rail system has found favor. It is employed almost universally on elevated systems and in subways, and is widely used on interurban lines. The current is conveyed through a third rail, placed beside the track; the motors are fed by shoes of metal which slide along this rail. Such a system is dangerous because of the exposed position of the rail that conveys the current, and it can be [illegible]d with safety only where the right of way [illegible]d to the public.

[illegible]c Cars. From street cars to locomotives, the construction of electrically-driven vehicles is simple. The essential parts of a street car are one or more electric motors, attached to the driving axles of the car by gears, and a switch on the platform for controlling the current. The motors and the running gear are attached to the trucks on which the car rests, and all parts which would be affected by dust are enclosed in metal casings. (For an explanation of the workings of the motor, see ELECTRIC MOTOR.) The revolving armature shaft, driven by the current received from the power house, is now generally connected directly with the driving axles by cogwheels. For ordinary city service the cars are equipped with four motors—one for each axle. Such motors vary greatly in power; those for light service may develop only twenty-five horse power each, while the motors used for interurban traffic will often develop 225 horse power. The engines used by the Pennsylvania Railroad in its New York terminals are driven by motors of 2,000 horse power.

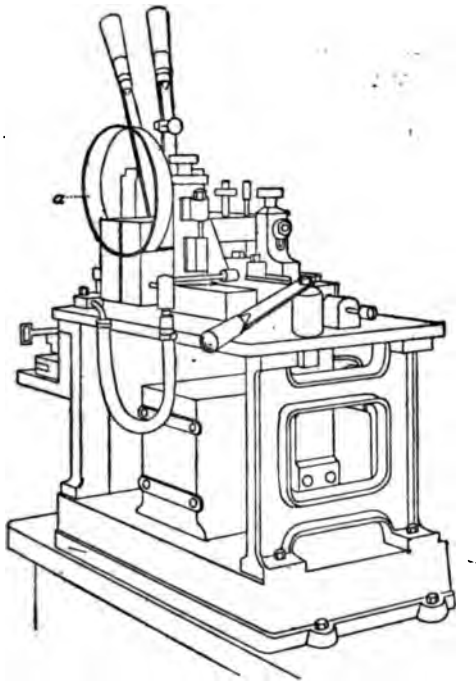
Advantages of Electric Power. The superiority of electricity as a motive power has been thoroughly demonstrated in the case of street railways and for interurban service. So far as steam railways are concerned, the case is not yet so clear, but the day is approaching when all trains will be economically run by electricity. The electric locomotive needs neither coal nor water and is less affected by cold weather than is the steam locomotive. It consumes no power while standing still, whereas a steam locomotive burns about one-half as much coal then as when running. But the cost of installing and maintaining electric equipment is enormous.

Mileage and Valuation. The *Electric Railway Journal* gave the electric mileage of the United States as over 43,000 in 1916. The capitalization reached about two and a half billion dollars. Canada, in the same year, had about 1,250 miles of electric lines, capitalized at more than $111,500,000. See, also, ELECTRICITY; ELECTROMAGNETISM. G.B.D.

ELECTRIC WELDING. The rails of street car tracks are frequently welded so as to form one continuous rail and therefore one conductor for the electric current, the trolley wire and the windings of the motors forming the other parts. This welding is done by means of the electric arc, the arc being placed near the junction of the metals to be welded. A flame from the arc falls upon the metals and melts the parts that are in contact. The above

is one of many instances of welding by means of electricity; in welding steel rails the carriage containing the apparatus for welding moves along the track, stopping at each spot where the work is to be performed.

In another form of electric welding a current is caused to flow through the metals, the



ELECTRIC WELDING MACHINE

In the illustration the circular band *a* is being welded. The ends to be fused are in contact at the lowest point in the circle. The machine shown will weld 200 steel bands in an hour, for only a few seconds are required to make an electric weld. A heavy current of electricity at a low voltage is passed through the abutting ends of the metal pieces to be welded, thereby generating heat locally at the points of contact, while at the same time pressure is applied to force the parts together.

ends to be welded being placed in contact, as shown in the accompanying illustration of a small electric welder. Since the resistance of this contact is very great, intense heat is developed, fusing the metals at the contact and making a perfect junction. E.E.B.

ELECTROCHEMISTRY, *e lek tro kem'is tri,* that branch of chemistry in which chemical changes are brought about by electric energy. In the voltaic cell chemical energy is converted into electric energy (see ELECTRIC BATTERY). This electric energy can again be transformed into chemical energy, and this principle underlies many thriving and important industries. The practical operations of electrochemistry may be considered under two groups—those which cause chemical changes at ordinary temperatures, and those in which the changes occur only at the high temperatures possible in the electric furnace.

A simple illustration of a change of the first sort is found in the analysis of water, or its separation into its component gases, oxygen and hydrogen. Electroplating (which see) is an extensive application of this sort of electrochemistry. Copper is also refined by the same process (see COPPER, subhead *Preparation*).

Metals which are extracted from their ores with great difficulty by ordinary processes are readily separated in the intense heat of the electric furnace. For instance, the production of aluminum on a commercial basis was not possible before the invention of the electric furnace (see ALUMINUM, subhead *Its Manufacture*).

The electric furnace possesses another advantage, that is, its power of separating the decomposed compounds by electric attraction, as in the production of aluminum. The metal when freed from its ore gathers around the anode, or positive pole, in the furnace, while the other substances are attracted to the cathode, or negative pole. In this way many substances in use in the arts are produced, chief among which are carbide, used in the production of acetylene gas; carborundum, a valuable abrasive; caustic soda; chlorate of potassium, and chloride of lime and bleaching powders. An excellent quality of graphite is also manufactured, rivaling that of the best mines.

Electrochemistry is a comparatively new branch of chemical science, and although it has made rapid progress since the beginning of the twentieth century it is doubtless still in its elementary stage.

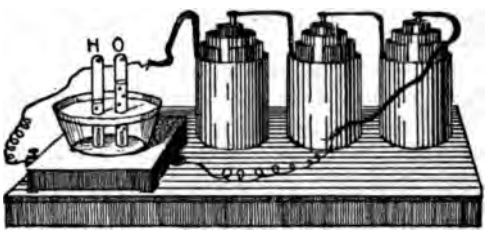
ELECTROCUTION, *e lek tro ku'shun,* a legal method for the infliction of the death penalty by passing through the body of the condemned criminal an electrical current of not less than 2,000 volts. Such a strength of current is enough to produce instant insensibility and painless death. After a long investigation by the legislature of the state of New York this method was pronounced more humane than hanging, and it became effective in that state in January, 1889. According to the law in that state, which has been taken as a standard by other states, there must be present at an execution, besides the prison warden, twelve citizens, seven deputy sheriffs, two physicians and one or two ministers, as the doomed man may

desire. In the article CAPITAL PUNISHMENT are listed the names of other states which followed New York's lead.

ELEC'TRODE, either terminal leading from an electric battery or other source of electromotive force. The word means *the electric way*. It is by way of an electrode that a current enters or leaves an electroplating bath, a Crookes tube, etc. See CROOKES TUBES.

ELECTROLYSIS, *e lek trol'i sis,* the process of decomposing a chemical compound by the action of an electric current, that is, separating the compound into the original elements or parts of which it is constituted.

A simple experiment illustrating electrolysis can be performed as follows: Connect four dry cells in series; place the ends of the wires



ANALYSIS OF WATER BY ELECTRIC CURRENT

leading from the dry cell battery in a solution of common salt in water. Bubbles will rise rapidly from the wire leading from the zinc of the battery, the cathode, or negative pole. In a short time a yellow color will appear in the solution at the anode, or positive pole. The salt has been separated into two parts, sodium and chlorine; sodium ions bearing a positive charge go to the cathode. There the sodium reacts with the water, setting hydrogen free. Chlorine ions bearing a negative charge go to the anode. An *ion* is one of the substances which appear at the poles when electrolysis occurs; that at the positive pole (the anode) is called *anion,* and that at the negative pole (the cathode) is called *cation.*

A substance which is decomposed in this way by an electric current is called an *electrolyte.* All acids, bases and salts are electrolytes. In some applications of electrolysis the electrolyte is kept in a molten state, as in the separation of aluminum from its ores (see ALUMINUM, subhead *Its Manufacture*). Some of the useful applications of electrolysis are the separation of some of the metals from their ores, or electric smelting; the manufac- of certain chemicals, such as bleaching and potassium chlorate; electroplating, and in refining copper (see COPPER, subhead *Preparation*).

An injurious effect of electrolysis is the decomposing of gas and water mains which run

WATER PIPE DESTROYED BY ELECTROLYSIS

parallel to the track of a trolley line in which the track is used as the return circuit. At certain places where the ground is a good conductor the current leaves the track and flows along the gas or water pipes for some distance. Where the current leaves the pipes electrolysis of certain compounds in the soil takes place, setting free chlorine or some other element to attack the pipes and injuring them by eating away the metal. The remedy lies in providing proper lines for conveying return currents.

Laws. There are three well-established laws relating to electrolysis, as follows:

1. The electrolytic action of the current is the same at all parts of the circuit.
2. The same quantity of electricity decomposes chemically equivalent quantities of different electrolytes.
3. The quantity of the electrolyte decomposed in a given time is proportional to the strength of the current. E.E.B.

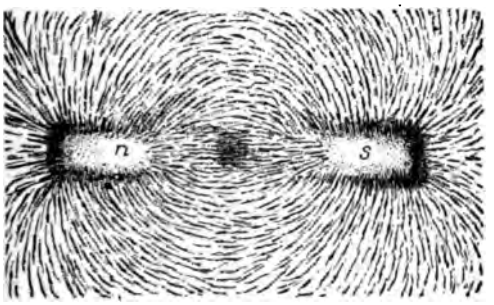
ELEC'TROMAG'NET, a magnet produced by the magnetic action of an electric current. An electromagnet consists essentially of a coil of wire having an iron core, and it is usually of horseshoe form. The story of the development of the electromagnet is the story of our modern electrical industries, for the electromagnet is the foundation of nearly all the great electrical inventions. Without it there could be no telegraph, telephone, electric light or electric power.

AT WORK
An electromagnet lifting twelve tons of iron.

Strong electromagnets are used for lifting

heavy weights of iron. The lifting magnet is lowered from the arm of a crane until it is in contact with the iron; the electric circuit is then closed and the magnet attracts the iron and holds it firmly. Magnet and iron are then lifted by the crane, swung to the place where it is desired to deposit the iron, when the current is cut off and the magnet releases its hold. In this way masses of iron weighing many thousands of pounds, as well as red-hot iron, can readily be moved.

The strength of an electromagnet depends on the number of turns of wire, the strength of the current and the permeability of the iron core. By the permeability of the iron core is meant the magnetic strength produced in the



Magnetic lines of force around a bar magnet.

iron by a certain magnetizing force; the greater the permeability the more strongly will a given current magnetize the iron. The invention of an insulating covering made it possible to wind many turns of wire on an iron core and produce a strong electromagnet (see INSULATOR). This in turn made possible the telegraph relay, in which a very weak current produces sufficient magnetic force to move the armature. It also made possible the strong electromagnets used in modern dynamo-electric machinery. See MAGNET AND MAGNETISM. E.E.B.

ELEC'TROMAGNET'IC THEORY OF LIGHT. According to this theory light consists of very short electromagnetic waves, commonly called electric waves, which are transmitted through the ether (see ELECTRICITY). The wireless telegraph message is also transmitted by waves in the ether. The two kinds of waves are known to be alike in many respects; either may be reflected from a mirror surface of metal; electric waves are bent on entering certain substances as light is bent on entering water; certain substances are transparent to electric waves as glass is transparent to light. The fact that light waves and electric waves are alike in so many respects leads to the belief that they are of the same kind, the only difference being in the length of the waves. It was Maxwell's mathematical proof that electromagnetic energy is transmitted by waves of the same kind as light waves, which led to the discovery of the wireless telegraph.

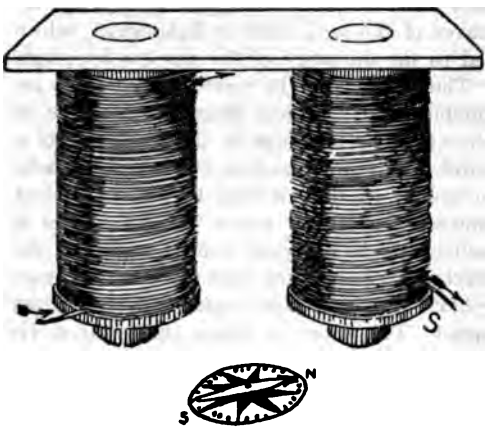
The waves used in wireless telegraphy are produced by a violent electrical discharge in the air. The discharge at the spark gap of a wireless telegraph sending instrument consists, according to the electron theory, of violent motion of electrons across the gap. Light is believed to be produced also by motion of the electrons. To produce light the electrons must vibrate in a very small space with very great speed. The space in which the electron vibrates is equal to that occupied by an atom. The speed is so great that the electron to produce light that is just visible (red light) must make about as many vibrations in a second as there are seconds in twelve million years. We know this because we know the number of light waves produced in one second and it requires one vibration for each wave. To produce white light the electron must vibrate much faster. Heating an object sets the electrons vibrating violently and thus causes them to send out very short electromagnetic, or light, waves. In this manner heat produces light.

Thus the electromagnetic theory of light and the electron theory of electricity fit together as parts of one theory and explain better than any other theory the known facts of electricity and light. E.E.B.

ELEC'TROMAG'NETISM, the branch of physical science which treats of the relations between electricity and magnetism. Whenever an electric current flows through a wire there is a magnetic field around the wire. An electric current is electricity in motion; electricity in motion is always accompanied by magnetic force.

A magnetic compass placed near a wire through which an electric current is flowing tends to place itself perpendicular to the wire. If a number of magnetic compasses are placed around a wire through which an electric current is flowing, the compass needles arrange themselves in the form of a circle, showing that the lines of force are circles. If the direction of the current is reversed, the compass needles will all turn around and again point out a circle, each needle pointing in the opposite direction from the first. Reversing the current reverses the direction of the force.

A coil with an electric current flowing through it acts like a magnet. The coil has a north and a south magnetic pole, as has a bar magnet; it retains its magnetic force only



AN ELECTROMAGNET
With many turns of insulated wire.

so long as the current flows. If the direction of the current is reversed the polarity of the coil is reversed. If an iron core is placed in the coil the magnetic strength is increased (see ELECTROMAGNET).

If an alternating current flows through a wire the magnetic field is reversed every time the current is reversed, as the experiment with the compasses referred to above shows. In this respect the magnetic field about an alternating current differs from that of a direct current, for a direct current of constant strength produces an unchanging magnetic field. If an alternating current flows through a coil, the magnetic poles of the coil change with every reversal of the current; if a second coil is placed near the first the changing magnetic field of the first coil induces an electromotive force in the second coil.

If a magnetic compass is placed in an alternating current coil, the needle is jerked back and forth as the magnetic force changes direction, but the needle cannot turn as rapidly as the magnetic field changes. The result is that the needle is demagnetized. The effect is similar to that of hammering a magnet (see, again, MAGNET AND MAGNETISM). A magnetized watch can be demagnetized by placing it in an alternating current coil.

Another example of the magnetic action of an alternating current is found in the telephone receiver, the core of which is a permanent steel magnet. The effect of the feeble *alternating current* which flows through the coil is not to reverse the magnetic field, as with a soft iron core, but alternately to strengthen and weaken the magnetic field.

Two principles sum up briefly the relation between electricity and magnetism.

1. Electricity in motion produces a magnetic field.

2. A magnetic field in motion across an electrical conductor produces an electromotive force (which see). E.E.B.

ELECTROMETER, *e lek trom' e ter,* an instrument for measuring electrical potential. The gold-leaf electroscope indicates roughly the difference of potential between the gold-leaf and the air. Electrometers are much more sensitive than the gold-leaf electroscope. (See ELECTROSCOPE, for illustration.)

QUADRANT ELECTROMETER

The principal forms of electrometer depend on the attraction of two disks of brass having unlike charges. A very small change in the charge causes a movement of one of the disks. The force which is required to bring the disk back to its original position is a measure of the electromotive force (which see).

In the quadrant electrometer a thin, flat piece of aluminum, called the needle, suspended by a fiber and turns in a shallo box of brass which has been cut into fo quadrants (see illustration). The quadra are electrically charged, two opposite qu rants being positive and the other two ne tive. The induced charges on the needle ca it to turn and the amount of turning indica the difference of potential.

The electrometer is used only in laborat work, and even then only when extreme sen tiveness is required. E.E.B.

ELECTROMOTIVE, FORCE, the force which tends to cause a flo of electricity. It may be compared to the pressure which causes water to flow through

Greater water pressure causes a greater
r of gallons per minute to flow through
, and in a similar way a greater elec-
ive force causes a greater quantity of
ity per second to flow through an elec-
cuit.

romotive force in a circuit is measured
ling the difference of pressure between
oints in the circuit just as one might
ıe difference of pressure between two
in a water pipe. The difference of
e between two points in an electric
is sometimes called *potential differ-*
this term and electromotive force mean
ally the same thing. The term *electro-*
force is usually abbreviated to its
nitial letters, e. m. f. The practical unit
tromotive force is the volt (which see).
e. m. f. of a battery is the difference in
ctric potential between the terminals of
ttery. The e. m. f. of single cells of
batteries is from one to two volts, de-
g on the kind of cell. The e. m. f. of
ery may be compared to the pressure
ed by a pump. The battery is the
of electric pressure, as the pump is the
of water pressure.

n an electric circuit is open, if a bat-
f a dynamo or other source of electro-
force is part of the circuit, then the
motive force tends to cause electricity
p across the gap. If the gap is not too
here is an electric discharge, or a spark,
the gap; if a discharge does not occur
ecause the electromotive force is not
enough to overcome the resistance of
r. Whenever there is a flow of elec-
along a conductor or a discharge of
ity through a non-conducting substance
use is an electromotive force.

high electromotive force is used in
itting electric currents over long dis-
Such currents are called *high tension*
s. The e. m. f. of the ordinary electric
g circuit for houses is from 110 to 120

very-day electrical parlance electromo-
rce is often called *voltage drop*, partic-
in referring to the difference of poten-
tween two points on a single wire. Thus
be said that the voltage drop of a
trolley line is ten volts, meaning that
ference of electric pressure between the
the line at the power house and the
end of the line is ten volts. In this
e e. m. f. between the trolley line and
the earth might be, for example, 550 volts at the power house and 540 volts at the farther end of the line, the difference being ten volts. When a car starts from the end of the line nearest the power house, in the example we are considering, the e. m. f., or the voltage drop, from the trolley to the track is 550 volts. When the car has reached the farther end of the line this e. m. f. is 540 volts. It is the e. m. f. between the trolley wire and the track that causes a current to flow from the trolley to the ground through the motor which runs the car. E.E.B.

ELECTRON, *e lek' tron.* See ELECTRICITY.

ELECTROPLATING, *e lek' tro playt ing,* the process of depositing a coat of gold, silver, nickel or other metal on a cheaper metal by means of an electric current. This method has almost completely superseded the old Sheffield method, in which the metals were welded together at a high temperature. In electroplating, the article to be plated is immersed in a solution of the desired metal, through which an electric current is then passed. The solution is decomposed by the action of the current (see ELECTROLYSIS), and fine particles of metal are deposited on the article to be plated. The longer the article is a part of the electric circuit the heavier will be the deposit. If several layers of metal are deposited, the article is known as *triple-plated* or *quadruple-plated.*

Electroplating is also used to make reproductions of medals and other metal pieces. First a mold or cast of the original must be made; this cast may be of some cheap metal, or it may be of wax or gutta-percha. This mold is carefully rinsed in an acid or caustic alkali solution, and then rinsed again in cold water. The mold may then be immersed in a solution of gold or other metal, as explained above.

The solutions in commercial use are numerous, but for gold, a solution of gold cyanide and potassium cyanide is commonly used, and for silver, a solution of silver cyanide and potassium cyanide. Platinum, zinc, copper and brass are among the other metals commonly used in electroplating. A special application of the principles of electroplating has been made to printing; by this method, type, engravings and etchings may be reproduced indefinitely. See ELECTROTYPING.

ELECTROSCOPE, *e lek' tro skope,* an instrument used for detecting the presence and nature of an electric charge. A simple electro-

scope can be made by suspending a pith ball by a silk thread from a glass support. If a body charged with positive electricity is brought near the ball the latter will be attracted to the object, become itself positively charged, and then be repelled. A much more sensitive instrument consists of two slender strips of gold leaf, suspended in a glass bottle from a metallic rod (see illustration). The rod extends through the cork of the bottle and terminates in a knob. If an object charged with electricity is brought near the knob the leaves become electrified, and since like charges repel each other, they fly apart and hang like a *V* upside down. Remove the object and the leaves resume their vertical position.

ELECTROSCOPE.

The electroscope is said to be charged when the electrified object is placed in contact with the metallic knob. In that case the leaves separate and remain apart. If a positively-charged body is brought near a positively-charged electroscope, the leaves will fly farther apart, but if the object has a negative charge they will fall toward each other. In both instances they resume their original charged positions when the outside electrified object is removed. The electroscope may be *discharged* by touching the knob with the hand, causing the leaves to collapse. Thus the electroscope may be used to determine the nature of the charge of any body brought near to it.

ELECTROTYPING, *e lek' tro type ing,* the process of making metal reproductions of type, engravings or etchings, by applying the principles of electroplating. The type or other matter to be plated is first carefully cleaned and then dusted with finely-powdered graphite. An impression of the type or engraving is then taken on a sheet of beeswax, which is coated with powdered graphite to make it a conductor of electricity. The next important [illegible] *to suspend* the wax mold in a bath, usually composed of two parts of sulphate of copper and one part of sulphuric acid slightly diluted in water. The negative pole of a battery is then connected with the wax mold, and the positive pole with a sheet of copper hung in front of the mold.

When the electric circuit is thus completed the copper is drawn from the plate and deposited on the wax. After several hours a thin shell of copper is found adhering to the wax. This shell is then backed up with lead or type metal to a standard thickness, and when the metal has cooled the back is planed smooth. The edges are then beveled, and the plate is ready for the press.

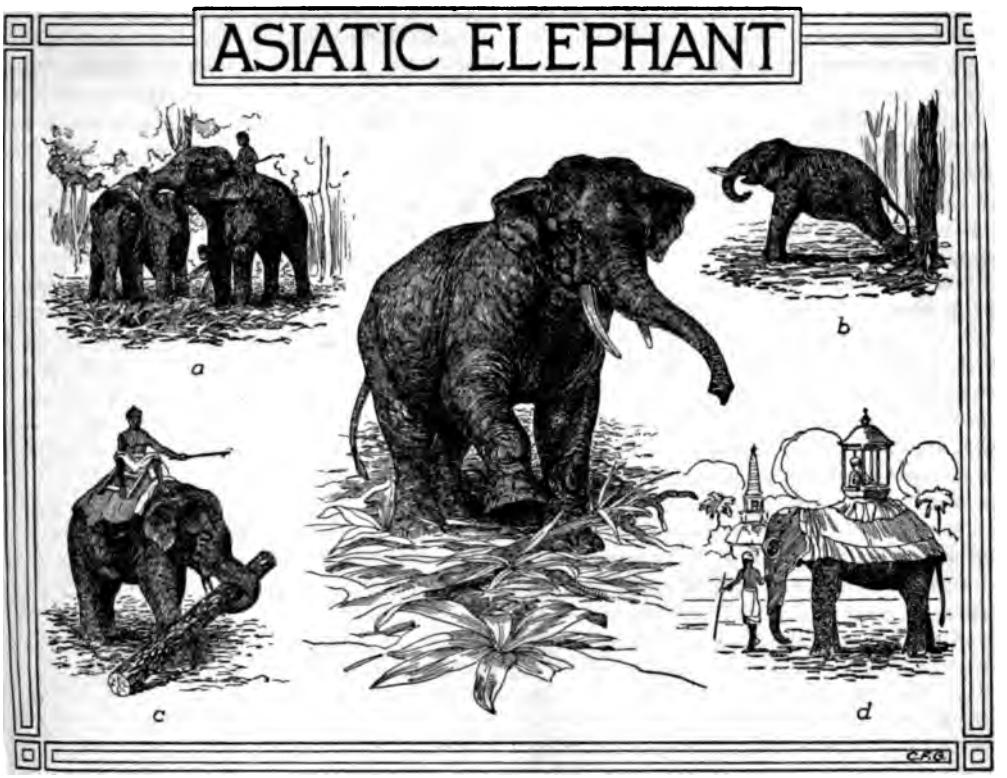
There are a number of minor variations possible in this process. Some electrotypes are made directly from the original plate, without the use of a wax mold. The surface of the original is first washed with a very weak solution of wax in turpentine, to prevent adhesion, and is then immersed in the copper sulphate bath. The thin copper shell formed on the original may then be used in turn as an original and an electrotype may be made from it. A wax-mold is supposed to give better results than this method, but the untrained eye cannot distinguish between the two kinds of electrotypes.

ELEGY, *el' e ji,* a poem in which the prevailing tone is that of melancholy. In English poetry the elegy is usually a lamentation over the death of a loved one, or a meditative poem whose mournful theme is inspired by the thoughts of death. Shelley's *Adonais,* in which the poet expresses his grief at the loss of his beloved friend, John Keats, is one of the most beautiful elegies of the former class. Another admirable example is Lowell's *Threnodia,* a tribute to his little son.

The greatest elegy of the meditative type in English literature is Gray's *Elegy Written in a Country Churchyard.* In this the poet passes from his contemplation of evening and the graves of the dead to a general reflection on the nature of human life, which is summarized in the famous lines:

The boast of heraldry, the pomp of power,
And all that beauty, all that wealth e'er gave,
Await alike the inevitable hour:—
The paths of glory lead but to the grave.

Still another form, known as the *pastoral* elegy, is illustrated by Milton's *Lycidas,* where the poet's sorrow over the loss of a friend is given a background of rural narrative. The Greek elegy was a short poem written in stan-



(*a*) Decoy (tame) elephant coaxing wild one into position in stockade so it can be tied. (*b*) Wild animal securely fastened prior to undergoing the ordeal of taming. (*c*, *d*) Tamed elephants at work.

as of two lines each, in which lines of five et and six feet alternated (see METER). The omans applied the term *elegy* to love poems the type written by the great lyric poet ullus.

LEMENTS. See CHEMISTRY, subhead *Ele- ts.*

EPHANT, *el'e fant,* a huge, clumsy-look- animal with long, flexible trunk, large ing ears, and rough, wrinkled hide of gray. It is the children's favorite in cir- and zoölogical gardens. The elephant largest land animal of the world to-day. are two existing species, the African and dian.

ral Characteristics. The body of an nt is very bulky. The legs are thick nost straight, and covering the toes are nails. Set on a short, thick neck is large head from which extends that f wonder, the long tapering trunk, or . This trunk, six to eight feet long, ension of the nose and upper lip, and ils run all the way through it to the is extremely sensitive. As the trunk is provided with nearly 40,000 very strong muscles, it can be turned and twisted in every direction and can be used as a weapon of defense or offense. Its chief use, however, is to obtain food and to carry it to the mouth of the animal. An object as small as a peanut can be picked up by the sensitive tip, or a large bunch of hay can be hooked up to be eaten. The trunk is also used to draw up water, which is poured into the mouth, and it likewise sounds the animal's loud trumpet call of anger or alarm. Valves in the trunk prevent food and water from going in farther than necessary to hold them on the journey to the mouth. As it is the seat of the keenest sense, that of smell, the trunk may be carried high in the air or close under the body in times of danger, as a means of protecting the organs.

The eyes of elephants are small and their sight is poor, but the sense of hearing is very acute, the ears, which hang downward, being large. The tail is short, slender and somewhat hairy. Covering the body is a thick, coarse hide, with only here and there a few hairs.

The cutting teeth (incisors) on either side of the upper jaw of elephants develop into long tusks, which are used for grubbing food or employed as weapons, and sometimes for carrying articles. Tusks vary in size, sometimes being quite small, but in well-grown males ofttimes weighing 200 pounds. The best ivory of commerce, used for billiard balls, chessmen and piano keys, is made of elephants' tusks. See IVORY.

Elephants grow from nine to fifteen feet high and weigh 4,000 to 10,000 pounds, or about four to ten times as much as the average horse. Although an elephant's head is large and its forehead broad, its brain is comparatively small; yet the animal shows much intelligence and can be taught. It is trained for many uses, as it can carry about a ton's weight at the rate of four miles an hour, in climates where horses could not be used as beasts of burden.

Differences between African and Indian Elephants. African elephants are larger, stronger and more fierce than those of Asia. Their hide is tougher; their ears are longer; they have three and four toes instead of five; the teeth are differently constructed, and both sexes have tusks, whereas only the male Indian elephant bears those weapons. The back of the African elephant slopes decidedly from shoulders to rump; the backs of the Indian species are straighter. African elephants have longer trunks than the Indian species, the trunks sometimes being so long they drag on the ground. Trunks of the Indian species end in a more flexible, fingerlike extension. Mountainous districts with scattered growths of trees are the favorite homes of African elephants, while Indian species delight in thickly-forested mountainous places. The smaller Indian species is the kind usually seen in menageries and at the circus, but the well-remembered mammoth *Jumbo* of Barnum's circus, the largest elephant ever taken into captivity, was brought from Africa.

African elephants are valued only as "big game" and for what the dead body yields—hides for native shields, flesh for food and, most important, the ivory tusks for weapons and as articles of commerce. But in India the living elephants also play important parts. At one time they took part in wars of the East, having been taught to fight with a kind of sword carried in the trunk. They are now trained in Asia for use in war to drag guns and to carry baggage. In India, especially, they are the tourists' delight, for they are a means of conveyance, carrying passengers in pavilionlike structures called *howdahs*, fastened to their backs. With the construction of new roads, however, elephants are now less used for that purpose. They are also used in many kinds of labor, such as rolling and carrying logs, fording streams with heavy burdens, etc., and in all their tasks show adaptability and understanding.

Elephants are also used in hunting tigers in India, the hunters being carried on the elephants' backs and shooting from that elevated and comparatively-safe position. Native rulers, the *rajahs*, keep elephants for traveling, and a rare species of white elephant is particularly valued for processions of Eastern princes.

Habits. Elephants are gregarious, or social, animals; that is, they live in large-sized herds. However, the old males, if they become very ferocious, are sometimes driven out and must live alone. In the jungles elephants feed at night on fruits, leaves of certain trees, barks of others, and on roots and cocoanuts. In captivity 600 pounds of fodder a day, preferably hay, are required, besides smaller amounts of sweet potatoes, sugar cane and rice. As they suffer keenly from the heat of the sun, during the daytime they rest in the shade or wallow in some stream. To lie down, an elephant must stretch its legs backward as if kneeling, so it does not often do that, but usually sleeps standing or leaning against a tree. As Shakespeare says in his *Troilus and Cressida:*

> The elephant hath joints, but none for courtesy; his legs are legs for necessity, not for flexure.

Female elephants bear usually one calf, but sometimes two. Calves suckle with their mouths, not their trunks, for about two years. When elephants are in captivity, however, they do not as a rule breed, and new captures must be made to increase or renew the stock. It has been estimated that an elephant will live about 150 years in natural surroundings.

Capture. Wild elephants are caught in various ways. Sometimes pits are dug into which the animals fall. The usual method, however, is by surrounding a herd with men on tame elephants and with beaters, and driving them into a large enclosure called a *keddah*. When the opening to the enclosure is neared, with great shouting, blowing of horns and beating of tom-toms the wild herd is crowded into

the enclosure, and the gates of tree trunks are closed. For a while the imprisoned animals dash about ferociously, but when they have quieted down somewhat, trained elephants with their drivers enter, and each wild animal is roped or fastened to the wall of the keddah or to a strong tree. Before long, through hunger and thirst, they become submissive and then may be tamed and trained.

Elephants of Long Ago. Since earliest times elephants have been known and trained for service. Egyptian monuments show representations of these beasts being led into Egypt. King Porus, when fighting Alexander the Great in Northern India, had war elephants in his army. With an army of elephants Hannibal inspired terror on his invasion of Italy. So, for centuries they have been used, and still plod patiently for their masters in many regions. Although usually gentle in captivity, they must be carefully watched for sudden displays of temper. With their powerful trunks they can encircle the waist of a man and hurl him to the earth with such violence as to kill him instantly. The fossil bones of two great extinct animals related to the elephant, the mammoth and the mastodon, are frequently found in Europe and America. See MAMMOTH; MASTODON. V.L.K.

ELEPHANTIASIS, *el e fan ti' a sis,* a name given to two diseases common in the Indies and other warm countries, so called because the skin of the sufferer becomes rough, in slight degree like the hide of an elephant. One is *leprosy* (which see); the other is the elephantiasis sometimes known as *Barbados leg.* The disease comes on slowly, one attack followed by another, and after each attack some part of the body, usually the leg, grows larger and larger, often reaching a startling size. Sometimes it is necessary to cut off the affected part. It is caused by the presence of a threadlike worm under the skin, which may have been transmitted by a mosquito. Change of climate and quinine will cure some cases. Lying in bed with the affected part elevated, and careful treatment by massage, elastic bandages, etc., will bring relief.

ELGIN, *el' jin,* ILL., a city famous for its manufacture of watches and as a butter market, is situated in the northeastern part of the state, in Kane County, thirty-seven miles west of Chicago. It occupies an area of about seven square miles along the Fox River. The population, almost entirely American, was 25,976 in 1910 and 28,203 in 1916. Elgin is on the Chicago, Milwaukee & Saint Paul and the Chicago & North Western railroads, and is connected with other railroads and the surrounding towns by interurban lines.

Industries. Dairying is extensively carried on throughout the fertile farm country about Elgin, and this occupation has made of that city one of the most important butter markets of the world. Current quotations of the Elgin Board of Trade, operating under a decree of the United States courts, establish the market price of high-grade butter throughout the United States. A great condensed milk company is one of the oldest manufacturing plants in the city, and its trade is world-wide. The Elgin National Watch Company, the city's largest industrial establishment, produces 3,000 watches daily. Elgin watches are well known in every part of the civilized world. Among a long list of other manufactured articles produced at Elgin are butter tubs, shoes, pipe organs, automobiles, coffin fixtures, rugs, lumber and sheet-metal products. More than 120 manufacturing industries give employment to over 8,000 people, and the annual pay roll aggregates nearly $10,000,000. The D. C. Cook Publishing Company and the Brethren Publishing Company are two well-known houses located here.

Public Buildings and Parks. Elgin is frequently called the *City of Churches,* in recognition of many handsome church edifices. Among many other prominent buildings are the fine city hall; the post office, erected at a cost of $150,000; the Gail Borden Public Library; the Y. M. C. A. and Y. W. C. A. buildings and the Masonic Temple. Lord's Park, located a little more than a mile from the center of the city, covers seventy-five acres and contains a number of small lakes, a pavilion, zoo and museum. Wing Park, containing 112 acres, has a fine golf course; Central Park is a small, attractive park close to the business district.

Institutions. In addition to its public schools, important among which is the high school building, erected in 1909 at a cost of $350,000, Elgin has the Elgin Academy of Northwestern University, Saint Mary's Academy (Roman Catholic) and a number of business colleges and music schools. Sherman Hospital, with its nurses' training school, is owned and conducted by the Elgin Women's Club. Saint Joseph's Hospital is in charge of the Sisters of Saint Francis. The Northern Illinois Hospital for the Insane, which accommodates

1,800 patients, was opened in Elgin in 1872. The Larkin Children's Home is supported entirely by voluntary contributions of citizens.

History. In Villa Street Park is a natural stone, marking the spot where the first white settlers, two brothers from New York state, erected a log house in 1835. The town was laid out in 1836 and chartered as a city in 1854. The commission form of government was adopted in 1912. The city water supply is obtained from artesian wells. E.H.K.

ELGIN, *el'gin,* JAMES BRUCE, Eighth Earl of (1811-1863), a British diplomat and colonial administrator, Governor-General of British North America from 1847 to 1854 and Viceroy of India for the last eighteen months of his life. Both in Canada and in India his work was constructive, and in both of these great British dependencies he had to proceed along untried lines; in Canada he was the first Governor-General to put into practice the principles of responsible government, and in India he was the first Viceroy appointed directly by the Crown. Elgin was the second son of the seventh Earl of Elgin, who is best remembered for his zeal in gathering a collection of sculpture and marble fragments from the Parthenon and other buildings in Athens. These have world-wide fame as the *Elgin Marbles* (see below). The son was sent to Eton and in due course to Christ Church, Oxford. There he was one of a small group, several of whom later became famous. One of them was William Ewart Gladstone.

EARL OF ELGIN

In 1841 Elgin, then merely James Bruce, entered the House of Commons as a Conservative, but before the end of the year the death of his father made him Earl of Elgin; the earldom was a Scotch peerage, which compelled him to retire from the House of Commons but did not entitle him to sit in the House of Lords. For the moment he had no opening for activity. Early in the next year he accepted the position of governor of Jamaica, where he remained four years, won the respect of all classes and improved the condition of the negroes. Almost immediately after his *return* to England in 1846 he was offered and accepted the Governor-Generalship of British North America. After his appointment but before his departure for this wider field he married Lady Mary Lambton, daughter of the Earl of Durham.

As the son-in-law of the popular Earl of Durham, Elgin was warmly received in Canada, but he had many difficulties to face. According to one of his biographers he laid down for his own guidance certain broad principles; that he should identify himself with no party, but make himself a mediator between the influential men of all parties; that he should retain no ministers who did not enjoy the confidence of the assembly or of the people; and that he should not refuse his consent to any measure proposed by his Ministry, unless it should be of an extreme partisan character such as the assembly or the people would be sure to disapprove. These principles are to-day accepted as commonplace, but in 1847 they were startling, and in 1848, when Baldwin and Lafontaine were summoned to form a Ministry, they were first actually put into practice. Responsible government, for which Canadians had fought for a generation, was an accomplished fact.

The Baldwin-Lafontaine Ministry introduced the Rebellion Losses Bill in 1849. This bill, which was really the conclusion of work done by previous governments, met violent opposition, both in Canada and in England, because it provided compensation for damages caused in the Rebellion of 1837, even though inflicted by persons in authority. The bill was approved by Elgin, in spite of great pressure brought on him to withhold his signature. On leaving the Parliament buildings in Montreal after signing the bill, Elgin was jeered and threatened by a mob, and on the evening of the same day, April 25, 1849, the Parliament buildings were burned to the ground. That Elgin's course met the approval of the British government, however, was shown shortly afterward when he was elevated to the English peerage as Baron Elgin.

After the excitement caused by the passage of the Rebellion Losses Bill had subsided, Elgin's frank and genial manners were of great service in restoring good feeling, and before very long he was generally spoken of as the most popular man in Canada. The chief event of the administration thereafter was the signing of a reciprocity treaty with the United States. After the negotiations had continued for nearly six years, Lord Elgin and Francis

Hincks finally went to Washington, D. C., and in a few weeks settled the terms, which included free trade in the natural products of the farms, forests, mines and seas. This treaty was abrogated by the United States in 1866.

At the close of 1854 Lord Elgin returned to England, his successor in Canada being Sir Edmund Walker Head. He lived quietly for two years, but in 1857 was sent to China on an important mission. He was then a member of the British Cabinet for a short time, and in 1859 was again sent to China as special ambassador to force Chinese compliance with certain British demands. He was successful and almost at once after his return to England, early in 1861, was appointed to the Viceroyalty of India. He was the first Viceroy after the great Indian Mutiny of 1857 and the first to hold his office directly under the control of the British government. Unfortunately he died before he could leave a sharp impress on the organization and policy of the Indian government. It is interesting to note that his son Victor, ninth Earl of Elgin (1849-), was Viceroy of India from 1894 to 1899. W.F.Z.

ELGIN, *el'gin,* **MARBLES,** a splendid collection of sculptures, mainly from the Parthenon in Athens, which was purchased from Lord Elgin by the English government in 1816 for $175,000 and placed in the British Museum in London. When Lord Elgin, who was very fond of art, was appointed British ambassador to Constantinople, he made plans to collect some of the ruined statues of the neighboring Greeks. During the year 1801 he worked steadily at the Parthenon (which see), gathering the principal figures from the pediments; he secured fifteen square slabs, called *metopes,* each decorated with two figures, and fifty-six slabs from the famous frieze. In addition he collected one of the Caryatids from the Erechtheum, part of the frieze of the Temple of Nike and numerous fragments, all of which he shipped to England.

The people in his native country either thought little of the collection or denounced him as a robber, until some of the prominent critics on art pointed out its wonderful historical and artistic value, for much of this work was done by the famous Greek sculptor Phidias. Even Lord Byron in *Childe Harold* mourned over "the walls defaced, the moldering shrines removed by British hands." In reality it was the best thing that could have happened to preserve this sculpture, for the Turks later overran the land and burned much of the marble to make lime for mortar, and probably these beautiful works of art would have met that fate. See PARTHENON; SCULPTURE.

E'LI, a high priest and judge of the Israelites for forty years, who took care of Samuel during his boyhood. Deeply pious himself, he was not a firm enough father to train his two sons to follow God, and for that reason he was warned that they would die in battle. When the news of their death was brought to him, he was also told that the Ark of God had been taken, and this shock killed him. See *I Samuel* IV, 18.

ELI'JAH, the great prophet-reformer of Israel, whose sole object was to awaken his people to the conviction that Jehovah alone is God. He lived at a period when there was a life-and-death struggle between the religion of Jehovah and Baal worship, because Ahab, king of Israel, had introduced the worship of other gods. By miracles and prophecies Elijah proved God's divinity and denounced the king for his crime, telling him that Jehovah would punish him. In *II Kings* II, 11, it is recorded that during the reign of the next king, Elijah was carried to heaven in a fiery chariot, after appointing Elisha as his successor. See ELISHA.

ELIOT, *el'i ut,* CHARLES WILLIAM (1834-), one of the most renowned of American educators, for forty years president of Harvard University. Higher education in the United States since the War of Secession has been more strongly influenced by Eliot than by any other man; chiefly to him are due the introduction of the elective system, the inclusion of all branches of knowledge as subjects for study, and the maintenance of highest scientific ideals in graduate and professional departments. These new principles he fought hard to establish, and before the close of his active career he had the satisfaction of seeing them accepted as fundamental and undebatable bases of higher education.

CHARLES W. ELIOT

Eliot was born in Boston on March 20, 1834, and was graduated from Harvard College at the age of nineteen. After graduation he became a Harvard tutor in mathematics, at the same

time pursuing advanced studies in chemistry. From 1858 to 1863 he was assistant professor of mathematics and chemistry at Harvard, and then studied in Europe for two years. Besides teaching him more chemistry, these two years gave him an insight into European educational methods which was of untold value to him a few years later. He returned to Boston to accept the professorship of analytical chemistry at the now famous Massachusetts Institute of Technology, which was then being organized.

In 1869, he began his long career as president of Harvard University, which was transformed under his administration from a New England college into a national institution. From the first days of his administration he showed a remarkable grasp of educational and administrative detail, but never lost sight of general principles. His breadth of interest, personal dignity of character and high ideals, all made him a man who held the admiration and loyalty of his staff. In matters of discipline, as of study, he deliberately allowed great freedom. President Eliot was a firm believer in athletics, although he did not fully sympathize with the later development of intercollegiate competition. In his college days he was an expert oarsman, and for many years rowing was his favorite form of exercise. In his later years he rode a bicycle, and even after his seventieth year he was a familiar figure in Cambridge streets on his early morning "spin." In 1909 his advancing years led him to lay down the heavy administrative burden which he had carried for four decades; his successor as president was Abbott Lawrence Lowell.

Eliot's sanity, mellowness and wide range of interests gave his old age a unique quality. He was, in many respects, the most distinguished private citizen of the United States. His views on education, religion, economics, politics and other topics were given respectful hearing. He edited the "Harvard Classics," popularly known as the "Five-Foot Shelf" of books, a selection of the world's best literature, whose careful reading, he said, would give any man or woman a liberal education. In 1909 President Taft offered him the ambassadorship to Great Britain, but Eliot declined on the ground of age. He was from 1909 a member of the General Education Board and a trustee of the Rockefeller Foundation.

He was a frequent speaker in public, and also the writer of a number of books, among them *Manual of Qualitative Chemical Analysis; American Contributions to Civilization and Other Essays; Educational Reform; The Happy Life; The Durable Satisfactions of Life; Four American Leaders;* and *The New Religion.* W.F.Z.

ELIOT, GEORGE (1819-1880), the pen name of MARY ANN (or Marian) EVANS, the foremost woman writer of English fiction. Together with her two great contemporaries of the Victorian Age, Dickens and Thackeray, she

GEORGE ELIOT

"Of all the women writers who have helped and are still helping to place our English novels at the head of the world's fiction, she holds at present unquestionably the highest rank."—*Long.*

has an assured place among those novelists who have helped to give English fiction its commanding position in the world's literature.

Marian Evans was born on November 22, 1819, at Arbury Farm, in Warwickshire, one of the Midland counties, about twenty miles from the town of Stratford, where Shakespeare was born. Her father, a plain, honest farmer of the type seen in the hero of *Adam Bede,* was agent for Mr. Francis Newdigate, and on his Arbury estate the novelist passed the first twenty-one years of her life. Some of the most interesting descriptions of scenery, character and incident that brighten her novels are reflections of her life in the English Midlands. She and her brother are pictured in *The Mill on the Floss* as Maggie and Tom Tulliver; the saintly Dinah Morris in *Adam Bede* is one of her aunts; and the sharp-tongued Mrs. Poyser, in the same book, her mother.

After studying for several years at two pri-

ıools for young ladies, Marian, at the ɜeventeen, was called by the death of her to take entire charge of the house- n the midst of the cares and responsi- ɔf her new duties, however, she found a vast amount of miscellaneous read- Then she was twenty-one the family l to the thriving manufacturing town ntry, where she formed a new circle of

Her most intimate associates were kers in matters of religion, and under luence she turned aside from her youth- rictions and became a freethinker her- his was the beginning of a spiritual that left her convinced that duty is reme law in life, an idea that finds ɔn in all of her novels.

19, on the death of her father, she trav- the Continent with friends, and after ırn to England began to write for the *nster Review*. She was soon made t editor of this magazine, an event ıarks the real beginning of her literary Herbert Spencer, Carlyle, Harriet Mar- ınd George Henry Lewes became her rsonal friends, and with the latter, him- vriter of some distinction, she formed lship that both regarded as marriage. the inspiration of his sympathy and ionship she sent to one of the mag- in 1857, her first story, *The Sad For- ɟ the Reverend Amos Barton*. This tale of the trials of a poor clergyman noble-hearted wife was published the ıg year with several other stories under *Scenes of Clerical Life*.

58 appeared her first long novel, *Adam* It was received by the public with an ısm for which its author was quite un- d, and it has always remained one of st popular books. Certainly it is one most natural and unlabored, for it is atively free from the analysis of char- ıd motive that is carried to an extreme ast novel, *Daniel Deronda*. In realistic al of country life and character *Adam* probably surpassed by no other book. ıllowed *The Mill on the Floss* (1860), in she reached the heights of beautiful ion, picturing with a tender and loving er own girlhood experiences.

Marner, the most perfectly-constructed novels, was published in 1861. In this led the miracle wrought in the life of t weaver who has lost faith in humanity o is reclaimed by the loving influence of a little child. *Romola* (1862-1863), her only historical novel, marks a change in background, for it is a picture of Italian life in the days of the great Savonarola. In *Felix Holt* (1866), *Middlemarch* (1871-1872) and *Daniel Deronda* (1876), she returned to English scenes and characters. Meanwhile, in 1868, she had produced a dramatic poem in blank verse, *The Spanish Gypsy*. Her last work, a collection of essays entitled *The Impressions of Theophrastus Such*, appeared in 1879, the year after Mr. Lewes died. His death was a terrible shock to her, and it meant the end of her creative vitality. Two years afterward she married John Walter Cross, who later became her biographer. She lived only six months after their marriage.

In George Eliot's novels there is more of tears than of laughter. She viewed life seriously, and the spiritual struggles of her characters, their development or their degeneration, were matters of supreme interest to her. Yet her novels are not all gloom. Her famous chapter in *Silas Marner* which describes the village worthies sitting about the tavern fire and philosophizing on ghosts is one of the brightest examples of humorous writing in English fiction. One of the strongest elements in her personal character was her craving for love and sympathy. Again and again this is reflected in the tender note that may be found in all of her stories, a tenderness which is nowhere more beautifully expressed than in the simple words which tell the tragic fate of Tom and Maggie Tulliver:

> The boat reappeared, but brother and sister had gone down in an embrace never to be parted; living through again in one supreme moment the days when they had clasped their little hands in love and roamed the daisied fields together. B.M.W.

ELIOT, JOHN (1604-1690), an American colonial missionary, called the "Apostle to the Indians," was of English birth and was graduated from Cambridge in 1622. He settled in Boston in 1631, where he devoted his life to bettering the condition of the Indians. His first step in this direction was to master their dialects, which he accomplished with the assistance of a young Indian convert. Besides his successful missionary labors he did much literary work of lasting value. His great life achievement was the translation of the Bible into the Massachusetts dialect of the Algonquin tongue. He also published an Indian grammar and assisted in the production of the Boy

Psalm Book, an English metrical version of the Psalms, the first book printed in New England.

ELI'SHA, a great prophet of Israel who, as successor of Elijah (which see), continued and carried forward the work which he had begun. He petitioned for a double portion of Elijah's spirit as he saw him carried up to heaven in the fiery chariot (*II Kings* II, 11), and many miracles of power and knowledge were performed by Elisha in the name of the Lord. He held his office for sixty-five years and was the last prophet to work miracles among the people of Israel.

ELIX'IR, from the Arabian *el ik sir,* or philosopher's stone, is in modern medicine a spicy, sweetened preparation or tincture used in medicine to disguise its disagreeable taste. In alchemy, or the chemistry of the Middle Ages, it was a substance which was supposed to have the property of changing the baser metals into silver or gold, of restoring youth and prolonging life. The word is also used figuratively in its modern sense, as in Bayard Taylor's *Lands of the Saracen,* "The air we breathed was an elixir of immortality."

ELIZ'ABETH (1533-1603), the "Good Queen Bess" of England, whose reign was one of the most glorious periods in the history of her

ELIZABETH

country. Adored in her own day as almost more than mortal, she has not lacked severe critics in the years that have followed, but as to the importance of her reign there cannot be two opinions. In literature the names of Shakespeare, Bacon and Spenser made it of surpassing worth; daring mariners sought new shores, and by their accounts stirred the imaginations of those at home; the beginnings of the colonial empire were made, and living conditions were so changed for the better that England was like a new country. Indeed, it was the transition time from medieval to modern England, and for most of the great advance Elizabeth was given the credit, justly or unjustly.

The Religious Question. Elizabeth was the daughter of Henry VIII and the famous Anne Boleyn (which see), and was declared heiress to the crown almost immediately after her birth. But when the queen fell from favor and was beheaded, the young princess was declared illegitimate and for a time had an unhappy life. Finally, however, she was given her place in the succession, after Edward and Mary, and during Edward's reign she lived a peaceful life. While Mary was on the throne she was more or less an object of suspicion, for it was well known that she had been brought up a Protestant, but at Mary's death in 1558 her right to the crown was unquestioned. The great issue confronting her was that of religion, and she showed herself capable of dealing with it wisely. She restored Protestantism, reinstated the English Book of Common Prayer and asserted the royal supremacy over the Church, but she avoided fanaticism and showed herself willing to call to her aid Catholic as well as Protestant ministers. Indeed, one of the things which most clearly showed Elizabeth's wisdom was her choice of councillors. She might object violently to their advice, but if they could once convince her that it was for the good of the country she usually yielded. Greatest of her ministers was Sir William Cecil (Lord Burleigh), in whom for forty years she placed implicit confidence.

The Marriage Question. One of the questions on which Elizabeth's first Parliament approached her was that of her marriage—there must be, they felt, a successor to the crown, or it might come into the hands of a Catholic. For a time Elizabeth played with the question. She would marry—then she would not; so all her life she was a coquette, yearning for love and flattery. She had her favorites, notably the Earl of Leicester, whom she would probably have married had she not feared the displeasure of her subjects; and she kept foreign princes, as Philip II of Spain and the Duke

of Anjou, waiting long for an answer to their suits, but in the end she announced her intention to live and die a virgin queen.

Mary, Queen of Scots. With this fascinating princess were connected many of the political events of Elizabeth's reign (see MARY STUART). Fleeing to England to seek the protection of Elizabeth, she was there imprisoned, and in 1587 was executed because of her supposed share in several Catholic plots. Elizabeth consented reluctantly to the death of her cousin and to the stern measures against Catholics which followed, but her reluctance did not save her from the wrath of the strongest Catholic sovereign of Europe—Philip of Spain, her former suitor. He determined to punish England, and dispatched the great Armada (which see), but the storms of the Channel combined with the superior seamanship of the British to destroy the great enemy fleet, and the result was new glory to England and its queen.

Character. Elizabeth was ludicrously vain, and had a violent temper which she did not hesitate to show by swearing, striking her courtiers, or spitting at them. In the diplomacy of the day, which consisted largely of intrigue and double-dealing, she was a master, winning by her ready falsehoods the doubtful praise, "She lived and lied for her country." But one thing counterbalanced all these undoubted faults in the eyes of her subjects—her love for England. This was genuine, and it was so strong that she was willing to sacrifice even her own preferences to it. A.MC C.

ELIZABETH, N. J., the county seat of Union County, two miles west of Newark Bay, four miles southwest of Newark and twelve miles southwest of New York City. It is served by the Central of New Jersey, the Pennsylvania and the Lehigh Valley railroads and by electric interurban lines, and has steamboat connection with New York City. In 1910 the population was 73,409; in 1916 a Federal estimate reported 86,690. The area of the city exceeds nine square miles.

Elizabeth is an old town and contains many places of historical interest; a number of colonial buildings are still standing. The streets are wide, well paved and shaded. The city has many attractive suburban homes of New York business men, and contains several parks, the county courthouse, city hall, public library, an orphan asylum and several hospitals. Elizabeth Port, a part of the city, is situated on Staten Island Sound and is an important reshipping point for iron and anthracite coal from the mines of Pennsylvania. The city has a large sewing-machine factory, shipbuilding plants, foundries, oil refineries, leather and rubber works, and manufactories of wire and cable, chemicals, paints, tools, electromotors, castings, machinery, hardware and tools. In favorable years the total value of factory products is over $29,000,000.

Elizabethtown, as it was first called, was settled in 1664 by a company from Long Island, and was the capital of the colony from 1755 to 1757. It was the early home of both Alexander Hamilton and Aaron Burr. During the War of Independence it was partially destroyed. Princeton University was founded at Elizabeth in 1746 as the College of New Jersey. M.W.

ELIZABETH CITY, N. C., a port of entry and the county seat of Pasquotank County, situated in the extreme northeastern part of the state, fifty-three miles south of Norfolk, Va., with which it is connected by the Norfolk Southern Railroad. Steamboats ply between the two cities through the Dismal Swamp Canal and the Albemarle and Chesapeake Canal. In 1910 the population was 8,412; in 1916 it was 9,710.

Elizabeth City is the seat of a state normal school for negroes and of the Atlantic Collegiate Institute, and has a United States customhouse. The trucking interests are extensive, and the city has a good harbor and a large domestic trade in cotton, lumber, fish and oysters. It has shipbuilding yards, cotton and hosiery mills, cotton gins, machine shops, iron works, lumber mills, and manufactories of carriages and wagons, barrels and baskets. It was settled and incorporated in 1793.

ELK, a splendid game animal of the deer family which, because of the ambition of hunters, is rapidly becoming extinct. There are two distinct species, the American and the European.

The American Elk, so named by early settlers, is more properly known by the Indian name *wapiti*, for its resemblance to European species, from which the name elk originated, is not close. Although it is rarely seen, and then chiefly in the Rocky Mountains and other westward ranges, the memory of this noble animal is preserved throughout America. Mountains, lakes, rivers, counties and towns where it was hunted for its teeth, horns, flesh or hide, have been named in its honor.

It is a strong-limbed, sleek-coated creature, standing about five feet four inches high at the shoulder, sometimes weighing 1,000 pounds.

The body is yellowish-brown above and nearly black beneath. The chest, neck and legs are dark brown. The males bear antlers which are between four and five feet long. They curve outward and backward, but their branches or tines turn forward. The male appropriates a number of females, and when mating time comes each male fights furiously with his rivals to acquire a herd. Female elks breed when two or three years old, and usually bear but one fawn at a time, although sometimes there are two or three. Unlike most deer, elk do not roam about at night. They feed on grasses, weeds, leaves and twigs during the morning and afternoon. In hot weather they spend hours at a time standing in water, to be rid of flies and mosquitoes. The winter feeding grounds are open hills.

While the wapiti enjoyed the freedom of the plains, Indians killed great numbers for the flesh, which they ate, and for the skins, which they used to cover their lodges or tepees. In the past, the elk was also hunted for its teeth and antlers. The teeth were used as badges or symbols of membership by the Benevolent and Protective Order of Elks (see ELKS) and the demand was so great that vast herds of animals were sacrificed to obtain them. To prevent complete extermination the elk is being carefully protected by law, both in Canada and the United States. The Order of Elks now use imitation elk's teeth made of metal or composition.

The European Elk, the largest of European deer, is similar to the huge, ungainly *American moose*, with its scoop-shaped antlers. It is an easily-tamed creature and has often been used as a beast of burden, but as such it has been largely superseded by the reindeer (which see). The elk is also strongly protected by law in European countries, but it is gradually becoming extinct. Some are still seen in forests of Norway, Sweden, Russia and Prussia.

THE EUROPEAN ELK

(For illustration of the wapiti, see article DEER.)

Another species of deer, now extinct, was known as the *Irish elk*. It was a large deer, distinguished by its enormous antlers, sometimes eleven feet from tip to tip. M.S.

Related Subjects. The reader is referred to the following articles in these volumes:

Deer	Reindeer
Moose	Wapiti

ELK'HART, IND., a city in Elkhart County in the north-central part of the state, fifteen miles east of South Bend and 101 miles nearly east of Chicago. It is on the Saint Joseph River, at the mouth of the Elkhart River, and on the Chicago, South Bend & Northern Indiana, the Cleveland, Cincinnati, Chicago & Saint Louis, the New York Central and the Saint Joseph Valley railroads. There is electric interurban service west and south. In 1910 the population was 19,282; in 1916 it was 21,858. The area of the city is six square miles.

Agricultural produce of the surrounding country is shipped from Elkhart. Important industrial establishments of the city include paper mills, automobile works, bridge and iron works and manufactories of musical instruments, furniture, carriages, machinery, gas generators, telephone supplies, corsets and rubber. Power for manufacture is supplied by a dam and power house built in 1913 at a cost of $750,000. The city has attractive parks, a fine high school building and a Carnegie Library.

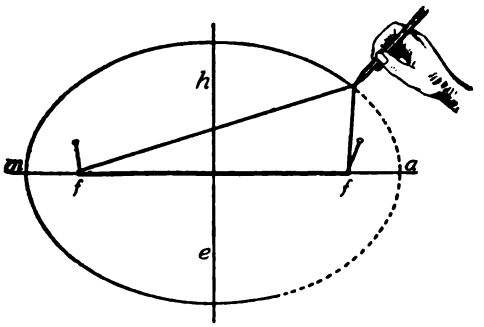
ELKS, BENEVOLENT AND PROTECTIVE ORDER OF, a social and benevolent organization founded in New York in 1868 by members of the theatrical profession, but now admitting any white male citizen of the United States of good moral character over twenty-one years of age. The order has one grand lodge and sub-lodges with club houses in many of the large cities which serve as hotels to members. An imitation elk's head, with or without the addition of the letters B. P. O. E., has, for humane reasons, replaced the elk's tooth as the official badge (see ELK). The society has a constantly-increasing membership and is said to have made greater charitable disbursements than almost any other fraternal organisation in the world.

ELLESMERE, *els'meer,* **LAND,** an uninhabited region almost entirely covered with glacial ice caps, which lies north of Jones Sound

and west of Northern Greenland. It was discovered by William Baffin in 1616, but up to 1899 very little was known concerning it. In that year Peary explored its surroundings and found that Grinnell Land, lying to the north, was a part of the same land. A year or so later Otto Sverdrup discovered its hitherto unknown west coast and several neighboring islands. See POLAR EXPLORATION.

ELLIOTT, *el'i ut,* MAXINE (1871-), an American actress who since 1908 has also been a theatrical manager and theater owner. She was born at Rockland, Maine. At the age of sixteen she moved to New York City to fight her way to success in her chosen profession. Her first appearance was in 1890 with E. S. Willard in *The Middleman.* Subsequently, she became identified with Rose Coghlan's company, and later, as a member of the Augustin Daly company, she went to London, where she was well received. In 1896 she joined Nat Goodwin's company, and to him she was married two years later, becoming his second wife, but within a few years secured a divorce. As co-star with Goodwin she appeared in a series of plays of diversified themes, produced both in England and America, embracing several Shakespearean rôles. Her first venture as an independent star was in 1903, when she appeared in *Her Own Way,* followed by *Her Great Match,* and *Myself—Bettina.* Since 1903 she has been owner and manager of the Maxine Elliott Theater in New York City. She is a sister of Gertrude Elliott, wife of Sir J. Forbes-Robertson.

ELLIPSE, *e lips',* the geometrical figure which most closely resembles in form the orbit of a planet. In geometrical terms an ellipse



AN ELLIPSE

The letters named, and the method of drawing an ellipse, are explained in the text.

is a conic section and a curve of the second order and second class. There are many mechanical appliances for drawing ellipses, called *ellipsographs,* or elliptic compasses, but the most simple method is to fasten the two ends of a piece of string at two points, called the *foci.* The string must be longer than the direct distance between the two points. With a pencil, keeping the string taut, an ellipse may be described. The diameter passing through the two foci is called the major axis; the diameter taken at right angles to this is the minor axis.

To find the area of an ellipse multiply half the length of the major axis by half that of the minor axis and multiply the result by 3.1416; this is a process that can be explained only by higher mathematics. In the accompanying figure the two *foci* are represented by *f f,* the major axis by *m a.* The minor axis is represented by *h e.* To ascertain the area assume that *m a* equals 64 feet and *h e* 48 feet. One-half of 64 feet=32; one-half of 48=24. 32×24=768. Multiply 768 by 3.1416, and the result is 2412.7488, the number of feet.

ELLIS, *el'is,* ISLAND, in New York harbor, might be called the "gateway to the New World." Through it must pass all immigrants who enter the United States through the port of New York, usually from two-thirds to three-fourths of all those who come to the country from overseas. In 1907 over a million newcomers were examined at the island for their fitness to become citizens of America, and the average number in subsequent years, until the War of the Nations in 1914, was above 700,000. After the immigrant has been accepted as a prospective American citizen he is taken upon a government vessel to the "Battery," the southern end of Manhattan Island (and therefore of the city of New York) and is then free to develop his ambitious plans in the New World.

The island is a mile southwest of Manhattan; it has been the property of the national government since 1808 and an immigrant station since 1891.

ELLS'WORTH, OLIVER (1745-1807), an early American statesman, distinguished for his sound judgment and activity at the Federal Convention, where he helped frame the Constitution of the United States in 1787. Having served in the Continental Congress for five years, and as judge in his state superior court, he was chosen to represent his state, Connecticut, at the Constitutional Convention. After the government was organized he was elected one of the first United States Senators from his state and was chairman of the committee

anized the entire system of Federal actically as they exist to-day. In was appointed Chief Justice of the Court. This position he held for ars, resigning to go to France with two ommissioners to negotiate a new treaty.

LEAVES AND SEED
(*a*, *a*) Flower stem and detail of flower; (*b*, *b*) seed body, with detail of same.

ELM, one of the "stately children of the wood," a tree valued for lumber and for ornament in America and Europe. The best-known species are the American and the English elm.

UMBRELLA FORM
...ington by the first President, ...apitol.

The most common form in which they ... the vase form, spreading out gradually from the base; another is the umbrella form, a long trunk branching out at the top much like a feather duster. Both forms are illustrated in accompanying drawings. In the spring the tree is covered with purplish buds, then greenish flower clusters appear, followed soon by winged seeds. In the summer the graceful branches of pointed, oval, tooth-edged leaves cast a welcome shade; and in the winter we

VASE FORM

know from the swinging, deserted nests ... that the elm is the favorite tree of the oriole.

The elm grows more rapidly than some other trees—the oak, for example—and often attains a height of seventy-five to 125 feet. Individual specimens known to be 200 years old are yet alive. The tough, hard, light-brown wood, so difficult to split, is valued for the manufacture of boats, barrels, wagon wheels and farm implements, and also for fuel. The outer bark of

some species is used in dyeing and sugar refining. One species, the *slippery elm*, a small tree with rough, hairy foliage, furnishes a gluey inner bark which boys like to chew, and which is used in medicine, especially in cases of sore throat. The inner bark of the *white elm* furnishes a strong fiber for cordage and cloth making. The *cork*, or *rock, elm*, with its corky bark, is the species of elm from which were made the hubs of the "wonderful one-hoss shay," made famous in Oliver Wendell Holmes's *The Deacon's Masterpiece*.

In the New England states elms are numerous and beautiful in both country and cities. There, in Cambridge, Mass., stands the "Washington Elm," under which General Washington took command of the Continental army in 1775 (see WASHINGTON ELM, for illustration). A beautiful white elm in Lancaster, Mass., is "the pride of the state." New Haven, Conn., is often called the "City of Elms."

Elm-Leaf Beetle. In 1837, the pest of European elms, the elm-leaf beetle, appeared in the United States and Canada and has since spread throughout America. It is a yellowish-brown beetle about a quarter of an inch long, with three indistinct stripes on the wings. The grub of this beetle is like a caterpillar, first black, gradually changing to yellow, with three dark stripes. The United States Department of Agriculture advises that a week or two after the grubs come out of the pupa stage and feed on the elm's new foliage, the tree should be sprayed with Paris green. M.S.

ELMI'RA, N. Y., the county seat of Chemung County, in the south-central part of the state, 147 miles southeast of Buffalo and 274 miles northwest of New York City. It is situated along both banks of the Chemung River and is on the Delaware, Lackawanna & Western; the Erie; the Lehigh Valley, and the Pennsylvania railroads. The Tioga division of the Erie Railroad, a line forty-six miles long, extends to the Pennsylvania coal fields. Interurban lines connect the city with neighboring towns and with the picturesque state park, Watkins Glen. The population in 1910 was 37,176; by a Federal estimate of 1916 it was 38,120.

Elmira covers an area of seven square miles, in a wide and fertile valley. Its parks include Eldridge, Rorick's Glen, Riverside, Brand, Diven, Grove, Maple Avenue and Wisner. The city has a Federal building, county courthouse, state armory, a state Memorial Library, Arnot Art Gallery, Arnot-Ogden Memorial Hospital, the Elmira Orphans' Home and the Home for the Aged.

The city is the seat of Elmira College (the first college for women in the United States), the Elmira Free Academy and the New York State Reformatory. The latter, a state prison for first offenders between the ages of sixteen and thirty, was the first institution of its kind to be opened in the United States, and has been a model for similar institutions in various parts of the world.

Elmira is an important railway center and has extensive railroad repair shops. Among more than 350 industrial establishments are steel plate works, rolling mills, fire-engine construction works, glass works, boot and shoe manufactories, boiler and engine shops, lumber and planing mills, iron and steel bridge works, factories for tobacco products, also silk mills, knitting mills and hardwood finishing works.

In 1779 the Battle of Newton was fought near the site of Elmira between American and Tory and Indian forces. After the War of Independence there were a few settlers here. A permanent settlement was made in 1788, and in 1815 it was incorporated as the village of Newton. In 1828 it was reincorporated as Elmira and became a city in 1864.

EL PASO, *el pah'so*, TEX., the county seat of El Paso County, is the only large city along 2,000 miles of Mexican border, and the largest city within a radius of 600 miles. It occupies the extreme western point of the state, 645 miles west and south of Dallas, 830 miles south and west of Denver and 815 miles east and south of Los Angeles. El Paso, on the American bank of the Rio Grande, and the interesting old Mexican town, Ciudad Juárez, are joined by a famous international bridge and an electric line.

The first railroad, the Southern Pacific, was built to the city from the west in 1881. It is now entered by the Atchison, Topeka & Santa Fe; the Texas & Pacific; the Mexican Central; the Mexico North Western; the El Paso & Southwestern; the Chicago, Rock Island & Gulf; and the Galveston, Harrisburg & San Antonio roads. Overland automobile routes pass through the city. During the thirty years from 1880 to 1910, El Paso grew from a settlement of a few adobe houses with a population of 736, to a modern city of 39,271 inhabitants. In 1916 there were 63,705 inhabitants, of whom nearly fifty per cent were Mexican.

Near El Paso is the lowest pass between the

extreme ends of the Continental Divide, hence its name. Since its founding the city has been the natural gateway between the United States and Mexico. It is situated at an altitude of 3,710 feet, on a broad plain sloping up to the hills northeast and northwest. Because of its high and dry climate it is a favorite health resort. In adjacent mountains are rich mines and large areas of exceedingly valuable pine timber. The Elephant Butte Dam on the Rio Grande in New Mexico, a few miles from El Paso, is the largest irrigation reservoir in the world, constructed at a cost of $10,000,000. This is one of several government projects which will reclaim hundreds of thousands of acres in the once arid valleys of this vast section.

El Paso is a city of fine public buildings and private residences, many of them constructed of reinforced concrete. Prominent structures are many fine banks, hotels, business blocks, churches and schools, a Carnegie Library, a Y. M. C. A., a Masonic Temple and club buildings, a courthouse and a city hall. A new Federal building to cost $700,000 was begun in 1916. The city contains the Texas State School of Mines, a summer normal school and business colleges. Fort Bliss, a regimental cavalry post, is three miles east. Through the city passes a large irrigation canal whose banks are beautified by landscape gardening. The fifteen parks contain nearly 150 acres, and are valued at $2,300,000. Cloudcroft, at an elevation of 10,000 feet, is a splendid natural park and resort in the neighboring mountains.

The total imports (consisting chiefly of cotton, cattle, silver, zinc, copper and lumber) which passed through the port of El Paso in 1915 had an appraised value of $9,149,410. Exports during the same year (consisting mainly of coal, shoes and cotton goods) were valued at $6,146,650. Metal mining is the greatest industry of this great section, and the *pay roll* of the El Paso smelting companies (copper, lead, silver and gold) is $1,000,000 annually. Among the most important manufactures are highly-finished white-pine products; smelter, foundry and shop products; cement, flour, brick, cigars, food products and household furnishings. El Paso is the market for the great cattle and agricultural interests of the surrounding country.

One of the finest office buildings stands upon what was once a part of the Ponce de Leon Ranch. The first settlement was made after the Mexican War and the town was chartered as a city in 1873. In 1910 the commission form of government was adopted, providing for a mayor and four councilmen. The waterworks system, costing $1,500,000, the supply being obtained from artesian wells, is owned by the city. During the border disturbances of 1916 several conferences between Mexican and United States generals were held in El Paso (See MEXICO, subtitle *History*). M.W.

CONTRASTS IN EL PASO

At the left, the American business center; at the right, the appearance of the Mexican section.

EL'WOOD, IND., a city in Madison County, centrally located in the state, fifty miles north and east of Indianapolis and 160 miles southeast of Chicago. It is on Duck Creek and on the Lake Erie & Western and the Pittsburgh, Cincinnati, Chicago & Saint Louis railroads. The population in 1910 was 11,028. The area of the city is about three square miles. Elwood has large manufactories of tin plate, shovels, kitchen cabinets, lamp chimneys and lawn mowers, and there are tomato-catsup and other canning factories. It has considerable trade in grain, live stock and produce. The principal public buildings are a Federal building, erected at a cost of $80,000, and a Carnegie Library.

ELYRIA, *e lir'i a,* OHIO, the county seat of Lorain County, in the north-central part of the state, seven miles south of Lake Erie and twenty-five miles southwest of Cleveland. It has an area of seven square miles and a favorable location at the junction of the East and West branches of the Black River. Both streams here descend forty feet and furnish

power for manufacture. Elyria is served by the Baltimore & Ohio and the New York Central railroads and by electric interurban lines. The population, which in 1910 was 14,825, was 18,618 in 1916.

Elyria was founded about 1819, was made the county seat in 1823 and became a city in 1892. It has a splendid natural park, a public library and a hospital. Large quantities of building stone and grindstones are produced from the Berea quarries in the vicinity. The city manufactures automobiles, telephones, home-lighting plants, canned goods, concrete blocks and moldings, paints, metal polish, switchboards, machine parts and iron pipe.

ELYSIUM, *e lizh'i um,* or **ELYSIAN,** *e lizh' an,* **FIELDS,** in classical mythology, the home of the good and blessed after death. When a soul left this world it was tried before three judges of Pluto, the god of the dead. If the good outweighed the evil, the soul was sent to this beautiful region, which had sun, moon and stars of its own and where all were happy and joyful. Early writers, such as Homer, considered the Isles of the Blessed as Elysium, while in later times it was thought to be a section of the lower world. Many poets refer to it as the land of pleasure and delight, as in Shakespeare's *King Henry VI,* Part III:

> How sweet a thing it is to wear a crown,
> Within whose circuit is Elysium
> And all that poets feign of bliss and joy.

EMANCIPA'TION PROCLAMA'TION, a famous proclamation issued by President Lincoln on January 1, 1863, which declared free all the slaves in the sections then fighting against the United States in the War of Secession. At the outbreak of the war great pressure was brought to bear upon President Lincoln to free the slaves in the seceded states. The early success of the Confederate forces drove him to the conviction that if the war were made a war against slavery as well as for the preservation of the Union, it would stimulate the Federal forces and possibly prevent foreign recognition of the Confederacy as an independent government. He waited only for some victory in the field to furnish a good opportunity to take the step. Early in September, 1862, Lee, at the head of 60,000 troops, entered Maryland in his first invasion of the North, and on September 17, after a terrible day's fight at Antietam, he retreated across the Potomac. Lincoln took this opportunity to issue, five days later, a preliminary proclamation of warning. In this he stated that if the seceded states did not lay down their arms and return to the Union within one hundred days, namely, on January 1, 1863, he would declare all of their slaves "forever free."

Accordingly, on New Year's Day he issued the final proclamation. The President believed it to be a necessary war measure, justified by circumstances. Slavery, however, was not legally abolished by this proclamation; this was effected by the thirteenth amendment to the Constitution, passed by Congress in 1865. See SLAVERY.

EMBALMING, *em bahm'ing,* the art of preparing bodies for burial, chiefly by the use of gums and chemicals, in order to preserve them temporarily from decay and to prevent infection. Three thousand years ago embalming was in such a state of perfection in Egypt that bodies were permanently preserved, but the wonderful secret was lost, and the world has not yet rediscovered it.

The development of modern methods dates from the beginning of the eighteenth century, when Dr. Frederick Ruysch used alcohol to preserve the internal organs and injected an embalming fluid into the arteries. His secret of the preservation of color and form died with him, but soon afterwards Dr. William Hunter, a celebrated anatomist, injected oils into the arteries and embalmed bodies so well that they are still preserved in the Royal College of Surgeons, London. A German preservative, which renders the dead body resistant to decay for years, while it retains its color, form and flexibility, consists of alum, sodium chloride, potash, arsenic and boiling water with glycerine and methyl alcohol. This liquid is used for saturation and injection. At the time of the American War of Secession, Dr. Thomas Holmes gave a great impetus to embalming in America by preparing many bodies of dead soldiers to be sent home.

After the blood is removed, about four quarts of embalming fluid are injected into the blood vessels and cavities of the body. The chief ingredient of this fluid is formaldehyde, but mercuric chloride, arsenic, zinc chloride and alcohol are also used.

Ancient Embalming. This art, which existed as far back as 4000 B.C., was carried to great perfection among the Egyptians, who embalmed not only human beings, but also cats, crocodiles and other sacred animals. These bodies, called *mummies,* have been found in all the ancient tombs of Egypt; for instance, in 1880 the mummy of King Men-en-te was

found at Saqqara in his pyramid, perfectly preserved after forty-five centuries. The Egyptians used three processes, according to Herodotus, the ancient historian. The first, which was very complicated, was the most expensive and was used only by the very wealthy people. The second, a cheaper method, consisted in injecting cedar oil into the abdomen and steeping the body for seventy days in a solution of caustic soda. The contents of the abdomen were then allowed to escape and the body was ready for burial. The cheapest method, which was employed by the poor, was simply to place the body in natron for seventy days, after rinsing the abdomen with a compound called syrmaea.

Kings and members of the royal family had beautiful tombs, such as the great Pyramids at Gizeh. In 1871 an Arab discovered a large tomb at Der El-Bahari filled with coffins heaped one on another. Many royal persons were found to be in the collection, among them Rameses II, whose features were again shown to the world after 3,200 years. E.C.

EMBAR'GO. In international law an embargo is an order forbidding ships in a port to put to sea A government may establish an embargo to gain possession of the ships of an enemy or to shut off supplies from a country with which it has a disagreement but is not at war. The first form, the *hostile* embargo, is no longer practiced; instead, The Hague agreement is observed which requires that ships in an enemy port at the outbreak of hostilities shall be given time to depart. The other form, the *civil* embargo, is still permissible, though uncommon

Outside of international law the word has come to mean a nation's prohibition of the export of a particular commodity. Thus, at the outbreak of the War of the Nations in 1914 England placed an embargo upon wool, and in 1916 there was an effort made to establish an American embargo upon foodstuffs, to reduce prices by keeping agricultural products in the country. Congress refused to consider the question.

Embargo Act. On December 22, 1807, in Jefferson's administration, the United States, exasperated by the repeated aggressions of Great Britain and France, forbade its ships to carry goods to foreign countries. It was thought that the offending powers would suffer if deprived of American commodites, but instead, the suffering was at home. New England, the center of foreign trade, was most severely affected and discontent there became so widespread that Congress repealed the embargo in February, 1809. It was succeeded by the Non-Intercourse Act (which see).

EMBEZZLEMENT, *em bez''l ment,* the dishonest appropriation of property by a servant, clerk or agent through his position of trust. Embezzlement is distinguished from larceny by the fact that in the former case the property is already in the hands of the thief as a trust and he appropriates it to his own uses. The offense is a crime in all states and provinces, and is punishable by imprisonment, usually for a term not less than five years.

EMBOSSING, *em baws' ing,* the art of producing raised figures upon plain surfaces, such as leather, paper, wood or metal. It was the earliest form of metallic ornamentation, and is usually employed for delicate or costly works, although a cheaper method has been adopted by forcing thin sheets of metal into dies. When a raised pattern is produced by blows or pressure upon sheet-metal, leather, cloth, paper, gutta-percha, etc., it is said to be *embossed.* Embossing of metal may be done by hand by beating up the metal from the under side, which method is called bossing, or *repoussé.* Writing paper and cards are embossed with two dies—a steel die and a counter-die, the latter being formed of millboard or leather, faced with gutta-percha. The paper or card is dampened, and a lever-press is generally used to fix the impression.

There is a method of embossing wood by saturating it with water, in which state a red-hot cast-iron mold is pressed heavily upon it. By a recently invented American process, veneers of wood are embossed with metal dies. In needlework, embossing is done by embroidering over figures padded with cotton or other material.

EMBROID'ERY, an artistic form of needlework, the fashioning of ornamental designs on cloth or other materials. The possibilities of embroidery have been known and appreciated from the earliest historic times, and it is to-day one of the most popular of the domestic arts. Something of its scope is expressed in the following lines from a poem by John Taylor, an obscure English writer of the seventeenth century:

Flowers, plants and fishes, birds, beasts, flies and bees,
Hills, dales, plains, pastures, skies, seas, rivers, trees,
There's nothing near at hand, or farthest sought,
But with the needle may be shaped and wrought.

The tools of the embroiderer consist chiefly of scissors, needles and a frame or hoop to hold the material. Small pieces of work do not usually require a frame. Various kinds of thread are used, including cotton and linen, silk, wools and twist. The different stitches, with their variations, are almost beyond number, familiar forms being the outline, the embroidery buttonhole, the cross, the satin, the feather, the herringbone, the chain, the crewel and the tent stitches. Directions for using these and other stitches are given in numerous instruction books, most of which are well known. There are also a number of good monthly publications devoted exclusively to needlework. Various stitches which are popular at any one time may be superseded shortly by new ones devised by the ingenuity of woman.

A great variety of articles in every-day use testify to the skill, care and patience required of the embroiderer. Handkerchiefs, dresses, underwear, towels, table linen, sofa pillows, sideboard and dresser scarfs, bed furnishings, doilies and curtains are representative of the many familiar articles that are beautified by this art.

Embroidery work has been found on mummy clothes in Egyptian tombs, 5,000 years old, and the art is known to have been practiced by the ancient Greeks and Romans. It was introduced into Europe from Byzantium (Constantinople), reaching a marvelous degree of perfection in the Middle Ages. One of the most celebrated examples of European embroidery is the Bayeux Tapestry (which see), a band of linen over 230 feet long and nineteen inches wide, embroidered in colored wools with seventy-two pictures representing scenes connected with the Norman Conquest of England in A. D. 1066.

Oriental embroidery has the same characteristics it possessed a thousand years ago. That of the Chinese and Japanese is very elaborate, most of the work being done upon silk, with the figures in brilliant colors of silk alone or combined with gold and silver. Besides silk and gold threads, beads, spangles, pearls and gems are used by the Persians, Turks and Hindus in their embroideries. In Central Africa, the girls of certain tribes decorate skins with embroidered figures of flowers and animals. The reindeer-skin garment of the Laplander is adorned with figures worked with a needle made of reindeer bone and with thread made of reindeer sinews. S.L.A.

Consult Christie's *Fancy Work for Pleasure and Profit* and her *Embroidery and Tapestry Weaving.*

EMBRYO, *em'bri o,* **AND EMBRYOLOGY,** *em bri ol'o ji.* In a general sense the word *embryo* refers to the beginning of anything, while it is still in an undeveloped condition. Specifically it refers to the beginning of life—the young plant within the seed, the chick within the egg, the unborn animal.

Embryology is the scientific study of the development of the embryo. It commences with the development of a germ cell, which may be a part of the body of another individual, a bud, or an egg, to the completed plant, animal or human being. Such study gives clues to heredity and so to the study of the development of a family of plants or animals or of a race of people. See CELL.

EM'ERALD, a well-known pure green precious stone, which when flawless commands a price almost equal to that of the diamond. It is a variety of beryl (which see), and is the softest of precious stones, though somewhat harder than quartz. Its natural form is either rounded or that of a short, six-sided prism. Emeralds of large size, free from flaws, are rare. The finest are now obtained from Colombia, but some excellent specimens have been found in North Carolina. One of the largest on record was the size of an ostrich egg and was worshipped by the inhabitants of the valley of Manta, in Peru, as the *mother of emeralds.* One specimen weighing over six pounds is now in the Royal Museum at Petrograd. In the book of *Revelation* the emerald is mentioned as forming the fourth foundation of the city of Jerusalem.

The emerald is the birthstone of May and signifies, in the so-called language of precious gems, success in love.

EMERALD ISLE, *ile,* a poetic and familiar name for Ireland, referring to its velvety-green vegetation. The name is said to have been first used by Dr. William Drennan in his poem *Erin,* a stanza of which follows:

Arm of Erin, prove strong, but be gentle as brave,
And, uplifted to strike, still be ready to save;
Nor one feeling of vengeance presume to defile
The cause or the men of the Emerald Isle.

EM'ERSON, RALPH WALDO (1803-1882), an American philosopher, essayist and poet, whose writings have never ceased to be an inspiration to noble ideals and right conduct. The keynote of his philosophy is self-reliance and individual

freedom, both in the intellectual and the religious life, and this ideal, which he consistently held up to the youth of his country throughout

RALPH WALDO EMERSON
"He was loved and reverenced as few men have been; his reputation shed lustre upon his country, and the stimulus he imparted to pure living and high thinking was extraordinary."

his career, found perfect expression in his own life and character. In the closing lines of his inspiring essay on "Self Reliance" may be found the summary of his creed:

> In the Will work and acquire, and thou hast chained the wheel of Chance, and shalt sit hereafter out of fear from her rotations. A political victory, a rise of rents, the recovery of your sick, or the return of your absent friend, or some other favorable event, raises your spirits, and you think good days are preparing for you. Do not believe it. Nothing can bring you peace but yourself. Nothing can bring you peace but the triumph of your principles.

Ralph Waldo Emerson was born at Boston, on May 25, 1803. His father, a scholarly and cultured minister of the Unitarian faith, was one of a long line of Emersons who had adopted the ministry as a calling. Ralph entered Harvard College when he was fourteen years old, graduating four years later, and after leaving college he taught school and studied theology. In 1826 he was ordained a Unitarian minister, soon becoming pastor of one of the leading churches of that denomination in New England, the Second Church of Boston. He was deeply spiritual, his independent [illegible] chafed at some of the Church forms, and in 1832 he bade his people farewell and retired from the ministry. Thereafter his life work was that of a lecturer and writer.

In 1833 Emerson made the first of several visits to Europe. There he met Landor, Coleridge, Wordsworth and Carlyle, and with the latter formed a lifelong friendship. In 1835 he married and removed to Concord, which was to be his home for the rest of his life, and where he had as neighbors the Alcotts, Hawthorne and Thoreau; the same year he began a course of lectures in Boston on literary and philosophical subjects. These were continued until 1837, the year in which he delivered at Harvard College his famous oration on *The American Scholar,* called by Oliver Wendell Holmes the "intellectual declaration of independence for America." Meantime, in 1836, he had published his first book, *Nature,* which sets forth more completely than any of his other works his doctrine of individual freedom.

The first series of his *Essays,* which appeared in 1841, contains some of his best-known discourses, such as "Self-Reliance," "Compensation" and "The Over-Soul." In 1844 a second series was published. By this time he had become identified with that group of New England idealists who are known as Transcendentalists (see TRANSCENDENTALISM), and for a brief period he edited their official journal, *The Dial.* In 1847, the year in which his first volume of poems was published, he visited Europe again, and during his sojourn in England delivered a course of lectures, some of which may be found in his *Representative Men* (1850). This journey also inspired *English Traits* (1856), a brilliant book of travel. Other notable prose writings include *Conduct of Life*

EMERSON'S HOME
"The house in Concord . . . . . was the goal of pilgrims from all civilized nations."

and *Society and Solitude.* He was continually before the public as a writer and lecturer until about 1870, when his health began to fail. His last years were spent quietly at Concord,

and he lies buried in beautiful Sleepy Hollow Cemetery, near the resting place of Nathaniel Hawthorne.

It is their nobility of thought more than their intellectual quality that has given Emerson's writings their enduring and far-reaching influence. His poems, like his essays, are reflective and serious, and though they have never become so popular as Longfellow's or Whittier's, among them are found some of the best in American literature. Representatives of these are *Each and All, The Rhodora, Threnody, Terminus* and his stirring *Concord Hymn,* sung at the completion of the Battle Monument, April 19, 1836. The first stanza of this poem is famous:

By the rude bridge that arched the flood,
Their flag to April's breeze unfurled,
Here once the embattled farmers stood,
And fired the shot heard round the world.

The Rhodora, his most charming nature poem, contains the often quoted lines:

Rhodora! if the sages ask thee why
This charm is wasted on the earth and sky,
Tell them, dear, that if eyes were made for seeing,
Then Beauty is its own excuse for being.

Emerson's lofty ideals and unfailing courage, which remained with him until the end of life, found perfect expression in the closing lines of *Terminus:*

As the bird trims her to the gale,
I trim myself to the storm of time,
I man the rudder, reef the sail,
Obey the voice at eve obeyed at prime:
"Lowly faithful, banish fear,
Right onward drive unharmed;
The port, well worth the cruise, is near,
And every wave is charmed."

The following books will be found helpful to those wishing to study more thoroughly the life and writings of the great essayist: *Correspondence of Emerson and Carlyle,* edited by C. E. Norton; Cabot's *A Memoir of Ralph Waldo Emerson;* Cooke's *Emerson: His Life, Writings and Philosophy;* Howell's *Literary Friends and Acquaintances;* Eliot's *Emerson as Seer;* Stedman's *The Poets of America.*

EMERY, *em'eri,* the stone used in making emery paper, emery cloth and emery wheels. It is blackish or bluish-gray in color, and is found in masses which look like boulders. Emery is an impure corundum (which see), is composed chiefly of alumina and quartz, is of coarse, granular structure, will not melt, and is not acted on by acids. It has been used for centuries for polishing gems and other stones, and in more recent times has had a wider use in polishing metals, in finishing wood and in sharpening tools. The finest grades are used for polishing gems and lenses.

The rock is ground to various grades of fineness, each being suited to some special purpose. The ground emery is then placed on cloth, paper or wheels. Emery cloth and paper are made by coating the fabric with glue and sifting the emery on it. Emery wheels are made by mixing the proper proportion of emery in the cement of which the wheel is made. The cement must be thoroughly mixed and of the right degree of hardness to wear away with the emery, or the surface will soon become uneven. The best emery comes from the island of Naxos, in the Mediterranean Sea, though it is quarried to some extent in the United States and Canada.

EM'IGRATION AND IM'MIGRATION. These terms relate to the same process, the transfer of residence from one section or country to another, as seen from different viewpoints. The European who leaves his native country with the intention of making his home in Australia, Canada or the United States, is an *emigrant,* literally, *one who goes away.* On the other hand, Australia, Canada or the United States regards him as an *immigrant,* that is, *one who comes in.* From the earliest ages of which any record exists men have changed their place of residence from time to time. Ancient tribes and races migrated in a body, sometimes thousands of miles. The migration of a tribe, however, is different from emigration. Modern emigration is a movement of individuals, not of tribes or nations; men may emigrate in groups of tens or thousands, but in every case the initiative comes from the individual, who desires to change his home.

Causes of Emigration. The causes of emigration are as varied as human nature; to sum them up in a word or a phrase is impossible. Many emigrants leave their homes from love of adventure, to seek their fortunes in a new land. The gold-seeker may wish to become rich in a brief time, but he is also an adventurer. Economic, political or religious oppression at home, or unusual opportunities for freedom urge both men and women to seek refuge in foreign lands. The emigration of the Russian Jews in the nineteenth and twentieth centuries, no less than the emigration of the Pilgrims in the seventeenth century, was due to these causes. Failures of crops, followed by famines such as those of 1845 and 1846 in Ireland, industrial depression following financial panics, and the reaction following political dis-

turbances, such as the revolution of 1848 in Germany, have all had a share in making thousands dissatisfied with their ancestral homes. On the other side, the new countries of the world offer advantages, such as cheap land, higher wages and a higher plane of living, which appeal especially to the poor or to those in moderate circumstances. The flow of immigration has been greatest to four sections of the world—Australia, Argentina, Canada and the United States.

The Relation of Governments to Emigration. In an obvious way emigration is a loss to the country from which it takes place. This loss is not necessarily an evil, for it may prevent overpopulation. Emigration does, however, mean a loss of able-bodied workmen, for nearly all emigrants are males between the ages of fourteen and forty-five. Recognizing the extent of this loss, governments have at various times forbidden their citizens from leaving the country. Since 1876, and more especially since the beginning of the twentieth century, the European governments have sought to protect their would-be emigrants, their health and morals as well as their purses, from unscrupulous agents. In addition, the home governments may furnish accurate information in place of the glowing and often deceptive accounts furnished by agents whose business it is to secure new settlers.

Relation of Governments to Immigration. The attitude of a country towards immigration is determined by a number of factors, but as a rule the younger the country the greater the inducements it offers to immigrants. The development of a new country requires human labor in constantly-increasing amounts, and every immigrant is an economic gain. Up to a certain but variable point all law-abiding, industrious immigrants are welcome, for they are assimilated by the whole population. They submit to the political, social and economic institutions of the land of their adoption, and they and their children become citizens. But when the flood of immigration passes the point of assimilation, when thousands of immigrants are arriving, and remain, for all practical purposes, foreigners in ideals, customs, language and even political allegiance, then the new country faces the problem of regulating immigration. This is the condition which now confronts the United States and, to a much smaller degree, other new countries. A country must also, for its own protection, exclude certain undesirable classes, including paupers, criminals and persons with contagious and certain other diseases.

Immigration to Canada. Canada's population, like that of the United States, is composed almost entirely of immigrants and their descendants. Most of the immigration to Canada has always been from the mother country and the United States. At the last Dominion census, in 1911, there were in Canada 784,500 persons born in the British Isles—almost exactly one-half of the Dominion's foreign-born population. Natives of the United States numbered over 300,000; of Russia, over 100,000; and of Austria-Hungary over 120,000.

The annual statistics of immigration are not quite accurate, for the reason that many of the persons who land at Canadian ports intend to settle in the United States, and many others, intending to settle in Canada, eventually drift across the border. If some allowance is made for these facts, the following table shows the fair annual averages of immigration to Canada, and the effect of the War of the Nations:

1871-1880,	annual average	35,000
1881-1885	" "	110,000
1886-1900	" "	40,000
1901-1905	" "	104,000
1906-1910	" "	186,000
1911-1914	" "	363,000
1915	(year ending March 31)	145,000
1916	" " " "	49,000

Since 1901 Canada has excluded immigrants who are physically, morally and mentally unfit. All immigrants must come to Canada by continuous journey from the country of birth or citizenship, on through tickets purchased either in that country or in Canada. In winter an adult immigrant, except an Asiatic, must have in his or her possession $50 and a ticket to destination; between March 1 and October 31 only $25 and a ticket are required. Relatives and certain other persons going to live with persons already settled in the Dominion are admitted without the money requirement. An Asiatic immigrant must have $200 in money and his ticket.

Immigration into the United States. From its foundation the United States has received more immigrants, and has had a larger proportion of immigrants among its population, than any other country. About one-third of all the people in the United States are of foreign birth or parentage. In the early years of the republic immigration was natural and commonplace, and no attempt was made even to count the immigrants until 1820. No law on the subject appears until 1864, when Congress

first officially encouraged immigration. From year to year there is considerable fluctuation in the number of arrivals, but the following table is a fairly-accurate index of the increase and of the effect of the War of the Nations:

1821-1830, annual average	14,000
1831-1840 " "	60,000
1841-1850 " "	171,000
1851-1860 " "	260,000
1861-1870 " "	231,000
1871-1880 " "	281,000
1881-1890 " "	525,000
1891-1900 " "	369,000
1901-1910 " "	880,000
1911-1914 " "	1,033,000
1915 (year ending June 30)	327,000
1916 " " " "	299,000

The "Old" and the "New" Immigration. There has been a gradual but marked change in the character of immigration to the United States. The most desirable immigrant is he who will be Americanized in the shortest time. Other things being equal, a Briton is the best, for he speaks the same language, has many of the same ideals and quickly adjusts himself to the new conditions. Germans and Scandinavians, being people of allied race and language, are next desirable, whereas the Chinese and Japanese, being totally alien, are theoretically least desirable. The fact is, as strikingly shown by the table below, that the "older" immigration was composed of the more desirable peoples, while the "new," or more recent arrivals, belong chiefly to nationalities which are not quickly assimilated to the conditions in the United States:

IMMIGRANT FROM	PER CENT OF TOTAL IMMIGRATION							
	1821-1830	1851-1870	1871-1880	1881-1890	1891-1900	1901-1905	1906-1910	1911-1914
United Kingdom	76.5	54.5	43.5	29.9	19.4	10.0	9.3	8.4
Germany	6.8	38.2	34.3	30.7	14.1	4.6	3.2	3.1
Sweden, Denmark and Norway	0.2	1.0	11.2	16.0	9.9	7.6	4.1	3.2
Italy, Poland, Russia and Austria-Hungary	0.3	0.4	8.1	19.4	49.3	66.8	62.5	63.6
All others	16.0	5.9	2.9	4.0	7.3	10.9	20.9	21.7

The Immigration Problem. With occasional exceptions, the proportion of educated and skilled laborers is much less in the "new" than in the "old" immigration. The old immigration, moreover, was usually by families, whereas the new, except among the Hebrews, is to a larger extent by adult males alone. The tendency of the new immigrants is to feel more keenly the difference between them and Americans and to congregate as separate communities in the heart of the great cities. Forty per cent of New York's population is foreign-born, thirty-five per cent of Chicago's, thirty-six per cent of Boston's and over thirty per cent of the population of a dozen other cities with over 100,000 people. The proportion among males of voting age in the great cities is even more striking. In Detroit fifty per cent of the men over twenty-one are foreign-born; in Cleveland the percentage is fifty-three; in Chicago, fifty-four; in New York, fifty-eight; and in Fall River, Mass., nearly sixty-four.

This tremendous increase, with its dangers to the standards of living of American-born workmen, is responsible for the demand, now more frequently heard than ever before, to keep out "undesirable" foreigners. In 1894 and again in 1913, 1915 and 1916, Congress passed bills restricting immigration to those able to read some language, but in each instance the bill was vetoed by the President, and the majority for restriction was not large enough to override him until early in 1917, when Congress passed such a bill over the President's veto. E.A.R.

Consult Fairchild's *Immigration, a World Movement;* Jenks and Lauck's *The Immigration Problem.*

ÉMIGRÉS, *a me gra',* the voluntary exiles from Paris during the French revolution, which began in 1789. After the Bastille (which see) was stormed by the mob on the night of July 14, the royal princes, followed by many of the nobility, left for the border line of France. In the autumn of the same year a larger number fled from the city, and in 1791, when a new constitution was adopted by those who wished to form a republic, France lost all of its aristocracy. Nobles, priests, monks and prelates crossed the frontier into Germany, Austria and Switzerland, and began to collect troops near Coblenz, where they formed a court around the princes.

The Revolutionists in Paris forced the king to notify the governments of Europe that France would look upon any country as an enemy which allowed preparation for war against France to be made in that country. Early in 1792 the German emperor refused to

interfere with the plans of the troops of the *émigrés,* and on the twentieth of April France declared war on Austria. The French army had little discipline, for most of the generals belonged to the nobility who had fled with the *émigrés,* so the Austrians gained an easy victory. When Napoleon became consul in 1799 he allowed all *émigrés* to return, but many did not go back until his downfall. When the Charter of 1814 was adopted, on the restoration of the Bourbons, they were not allowed to regain their estates or former privileges, nor were they ever fully restored.

EM'INENT DOMAIN', the right of the nation or a state or province, or of public service corporations to whom the power has been lawfully given, to condemn private property for public use. The ownership and possession of such property is then appropriated to the announced public use after the owner is paid due compensation, to be ascertained according to law.

When a railroad surveys for a right of way and a property owner refuses to sell his land through which the survey runs, the railroad may appeal to the courts. An appraiser is appointed who names a reasonable price at which the property owner must sell, or a jury determines the price in what are known as *condemnation proceedings.* In like manner city land is taken for public schools, asylums, municipal buildings, etc. This authority of the state to compel the property owner to sell his land for public purposes is known as the *right of eminent domain.*

The constitutional laws of the United States and Canada provide that no person can lose his property by eminent domain except it be taken for public use, by due process of law, and for just compensation. The phrase "public use" has been liberally interpreted by the courts to include not only public improvements carried on by the state, such as the construction of harbors, canals, fortifications, etc., but also semi-private enterprises in which the public has an interest, as railroads, bridges, mills, etc. The most extended application of the right of eminent domain possibly in the world's history was the determination in 1915 to destroy the village of Osborn, Ohio, in order to build a vast reservoir to receive flood waters and prevent a recurrence of the great flood which devastated Eastern Ohio in 1913. The state paid the people of Osborn $1,500,000 [illegible] their property and for the expense involved [illegible]*nding* new homes elsewhere. M.R.T.

EMIN PASHA, *a'meen pashaw'* (1840-1892), an African explorer and surgeon, who was made pasha, or governor, of the equatorial provinces in the Southern Sudan in 1878 by General Gordon; this position he held for eleven years. He was born of Jewish parents at Oppeln, Prussia, his real name being EDOUARD SCHNITZER. After receiving his degree in medicine at Königsberg, he was appointed surgeon in the Turkish army, where he adopted the name Emin, meaning *faithful one.* In 1876 he entered the Egyptian service, and in 1883 the uprisings of the dervishes under the Mahdi cut off his country from the civilized world, until Stanley reached him in 1888. He could not be persuaded to leave his people, but in the following year they deposed him and he returned to Egypt. A little later he went on an exploring expedition for the German East Africa Company and was assassinated by two Arabs. See STANLEY, HENRY MORTON.

EMMET, *em'et,* ROBERT (1778-1803), an Irish patriot, born in Dublin. He was a fellow student with Thomas Moore at Trinity College, and afterwards spent some time on the Continent, where he tried to interest Napoleon and Talleyrand in his effort to free Ireland from English rule. Upon his return to Ireland he led an unsuccessful revolt against the English viceroy in Dublin Castle. He escaped, but returned a few days later to visit his sweetheart, Sarah Curran, when he was arrested, tried, condemned and hanged. His speech just before his execution is considered a brilliant example of fiery patriotism. His attachment to Miss Curran inspired Moore's famous poem, *She is Far from the Land Where Her Young Hero Sleeps.*

EM'PEROR, an imperial title, first used by Julius Caesar in 58 B.C., which is to-day given to the supreme ruler of an empire. It originated in the Latin term *imperator,* meaning *general,* by which the military governors of provinces were known. Up to the fifth century the Roman rulers used the title, and in 800 Charlemagne revived it as the name of the sovereign of the Holy Roman Empire. In 1804, just before that empire came to an end, the last ruler, Francis II, declared himself hereditary emperor of Austria. Peter the Great of Russia had assumed the title in 1721, and the king of Prussia was crowned emperor of united Germany in 1871.

EMPIRE, *em'pyre,* a term used to denote a country of vast extent, whose ruler is usually

called *emperor,* but he may be distinguished by another title of similar import, as *sultan,* in case of Turkey. An empire generally consists of a number of small countries united to form one strong federation, as the result of political union, colonization or conquest. A *kingdom* is usually less extensive than an empire, and is under the sovereignty of a king or queen.

EMPIRE DAY, a day specially set apart in Canada and throughout the British Empire—"in the Overseas Dominions, in India, Australia, South Africa and the islands of the sea"—to foster patriotism among school children. The date is May 24.

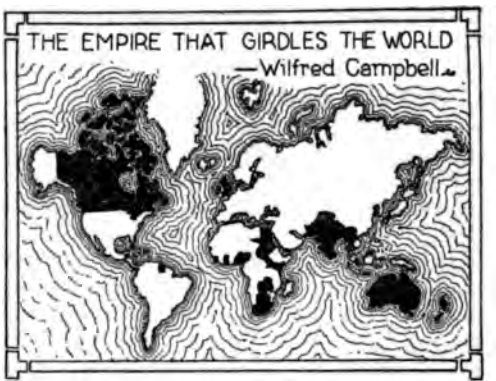
In all schools of the Empire the morning hours are spent in a study of the geography and history of the British Empire and of its greatness. The afternoon is devoted to public addresses, recitations, essays and music of a patriotic nature. Sometimes the celebration is held in the open air with the public participating, and drills, exercises and saluting the flag add to the interest of the occasion.

Empire Day was originated in 1897 by Mrs. Clementina Fessenden of Hamilton, Ont. The *Empire Movement* has since become nation-wide. It has been greatly promoted by Lord Meath, an ardent imperialist.

The motto of the day is "One King, One Flag, One Fleet, One Empire." Its watchwords are "Responsibility, Duty, Sympathy, Self-Sacrifice." Its object is to inspire the children to cherish patriotism, to learn citizenship, to follow duty, to acquire knowledge, to practice discipline, to subdue self, to consider the poor and suffering. Its rallying cry is "For God: For Duty: For Empire." G.H.L.

EMPLOY'ERS' LIABIL'ITY, the liability of employers for injuries sustained by their workmen while actually engaged in their occupations. Under the common law of England and until recently under that of the United States and Canada, the courts have always assumed that an employee, on accepting work, understands and tacitly agrees to accept all the ordinary risks of his occupation, including negligence on the part of his fellow-employees. The employer, on his side, was supposed to be liable for gross negligence and for any special risks which he imposed, but it was seldom that an employee could prove his master even indirectly responsible.

With the introduction of the factory system, the increased use and growing complexity of machinery and the weakening of the



Empire Day

A Suggestive Program

One voice, one people, one in heart,
And soul, and feeling, and desire.
—*Sangster.*

Song, *God Save the King*
Flag Salute
England .....*Wilfred Campbell*
Essay, *What Empire Day Means*
Canada.....*The Duke of Argyll*
Essay, *How the Union Jack Was Formed*
The Union Jack
Essay, *Rise of England as a Sea Power*
The Colours of the Flag.....*F. S. Scott*
Essay, *Jacques Cartier*
Jacques Cartier.....*T. D. M'Gee*
Essay, *The Father of New France*
Canada.....*Charles G. D. Roberts*
Song, *The Maple Leaf Forever*
The Maple.....*H. F. Darnell*
Essay, *The Hudson's Bay Company*
The Voyageur's Song....*J. F. M'Donnell*
Essay, *Wolfe and Montcalm*
Song for Canada.....*Sangster*
Essay, *What Railroads Have Done for Canada*
Canada.....*J. E. Middleton*
Hands All Round.....*Tennyson*
Recessional .....*Kipling*
Song, *Oh Canada*

and *enabling* the inhabitants to hold a constitutional convention and draft a constitution to be submitted to Congress for approval. In Canada a province is formed by act of the Dominion Parliament, approved by the King in Council, but this is not usually termed an enabling act.

ENAMEL, *en am'el,* a glasslike glaze of various colors fused to the surface of gold, silver, copper, iron and other substances. Enameling is one of the decorative arts, seen at its best in association with the jewelers', goldsmiths' and coppersmiths' work. Enamel painters have always cherished their art as something apart and independent, and many beautiful things have been done with it, from the jewel-rich panels of Nardon Penicaud, an artist of Limoges, to the finely-finished portraits of Leonard Limousin and the exquisite miniatures by Jean Petitot.

The art of enameling is of great antiquity, for it was practiced by the Assyrians and the Egyptians. Since then all countries have interested themselves in the art. Distinguished with reference to the manner of execution, enamel-work is generally divided into four kinds:

(1) The *Cloisonné,* or inclosed, the method of the Byzantine school, in which the design is formed in a kind of metal case of gold or copper and the colors separated by delicate filigree gold bands;

(2) The *Champlevé,* practiced by the Rhenish and early Limoges schools, in which the figures to be filled in with color are cut in the metal to some depth and the colors separated by a thin partition of the metal to prevent running into each other when fired;

(3) *Translucent enamel,* which had its origin and was brought to great perfection in Italy, composed of transparent enamel of every variety of color laid in thin coatings over the design, which was incised on the metal;

(4) *Surface-painted enamels,* in which the metal plate was covered with a coating of dark enamel for shadows and painted on this with white, the colors being laid on with a hair-pencil and fixed by firing.

The best of the artistic enamel work of the present day comes from the Japanese, but from China and India also come some fine examples. Enamel is also now used for glazing the cheaper varieties of pottery and for coating iron vessels for domestic purposes. A great variety of articles, such as grate-fronts, clock dials, panels of different kinds, bedsteads, name plates, etc., are also executed in enameled iron.

ENCYCLOPEDIA, *en si klo pe'di a,* or **CYCLOPEDIA,** a term which comes from the Greek word meaning *circle,* originally used to denote the group of arts and sciences without study of which no freeman was considered really educated. From this the word came to mean books dealing with these studies, and so in time took on its present significance of a work in which the various branches of learning are treated in separate articles, usually alphabetically arranged. Of such works of reference in the modern sense the ancients knew nothing. A scholar might set down for the use of students all of his information on any subject or on all subjects, but no attempts were made to cover the entire field of human knowledge or to have different portions of such works contributed by specialists. For instance, a Roman named Varro, who died about 25 B.C., produced a work in nine volumes, each of which was devoted to some one subject, and the elder Pliny wrote a famous *Natural History* which purported to give all that was known of the natural sciences. This is the oldest work of an encyclopedic character.

During the Middle Ages several works of a similar kind appeared, but all were arranged topically, and none of them were systematic. The name *Encyclopedia* was first used in 1559, and in the next century appeared the first work in which the subjects were alphabetically presented. This was the *Dictionnaire historique,* published in 1674 by Louis Moréri, which was immediately successful and passed through several editions. Bayle's *Dictionnaire historique et critique,* which appeared in 1697, was the most noteworthy work of that character which had been published up to that time, and attained considerable success in English translations.

In 1704 the first work in English was issued which deserved the name of encyclopedia—the *Lexicon Technicum, or an Universal English Dictionary of Arts and Sciences,* but this was far surpassed by Chambers' *Cyclopedia,* which appeared in 1728. History and biography were omitted, but the cross-reference system was used in this work. A translation of Chambers' work was the first encyclopedia issued in Italian, and, far more important, a French translation was the basis for the famous encyclopedia of Diderot, D'Alembert and their associates. This was more than an encyclopedia, for the authors used it as a means for expressing their own political and religious principles.

In 1771 there appeared a work which has

served as the foundation of the chief encyclopedic work published in England—the three-volume *Encyclopedia Britannica.* In its later editions, to the ninth, emphasis was laid rather on long treatises on important subjects than on brief discussions on the thousands of minor topics found in most encyclopedias; but in the eleventh and latest edition, in twenty-nine volumes, the two plans are combined, so that the *Britannica* in its present form more nearly resembles other encyclopedias. Other works in English which are worthy of note are the *New International Encyclopedia,* in over twenty volumes, and the *Americana,* in sixteen volumes. The chief German encyclopedias are Brockhaus's *Konversations-Lexikon* and Meyer's *Neues Konversations-Lexikon;* while among the chief French works of this kind are the *Encyclopédie des gens du monde,* the *Dictionnaire de la conversation et de la lecture* and *La grande encyclopédie.*

The earlier encyclopedias were chiefly designed for specialists in the various fields, and made no attempt to avoid technical terms and abstruse language. Within the last few decades, however, there has been an increasing tendency to simplify such works so that the general reader may profit by them. Encyclopedias have also been issued which have been intended primarily for children and young people, and which lay stress on all such topics as will help them in their school work. One such work, the *New Practical Reference Library,* which appeared in 1907, had a greater sale than any other work of reference ever issued. Probably no other publication, excepting the Bible, has sold so many copies. The WORLD BOOK is the first which has made its aim the accurate and scholarly discussion of all topics which belong to the province of a thorough work of universal reference in language which children can understand.

ENDICOTT, JOHN (1588?-1665), a fearless and courageous leader of the little Puritan company of sixty persons which settled at Salem, Mass., in 1628, and the man responsible for the establishment of a colonial mint in 1652. His fiery religious zeal led him to leave the home of his birth in Dorchester, England, and join the Puritans in their search for a new home in America. He was governor of his colony for several terms and was a stern ruler. At one time he shipped two of his council back to England for wishing to use the Episcopal prayer book in the public worship, while in 1635 he slashed the red cross out of the English flag because it seemed to him an emblem of the Pope.

ENDIVE, *en'div,* a slightly bitter plant, somewhat like chicory, which is used as a salad, especially when lettuce is out of season. The curled, or narrow-leaved, variety, is most popular, but the broad, straight-leaved endive is also widely used in Europe and America. If grown like lettuce on good garden soil, the only additional care necessary to prepare it for the market is blanching (see ETIOLATION). This is done by lightly tying the outer leaves together. It must not be done, however, when the leaves are damp, for then they will decay.

An illustration appears in a color plate shown with the article VEGETABLES.

ENDYMION, *en dim'i on,* in Greek mythology, a beautiful youth who had asked Zeus (Jupiter) for eternal slumber, and whom, while he was sleeping on Mount Latmos, Diana saw and kissed. The legends regarding him vary greatly, describing him as a king, a hunter and a shepherd. A statue of the sleeping Endymion was found at Hadrian's Villa at Tivoli, and is now in the National Museum at Stockholm, Sweden. The myth was the inspiration of Keats' *Endymion.*

ENEMY, *en'e mi,* a term applied to any state or country at war with another, or to any member of such country's naval or military forces. A private citizen of a hostile nation, according to international law, is not an enemy, and must not be treated as such. However, should that citizen attack, hinder or in any way interfere with hostile troops, he may at once be regarded as an enemy and so treated. All commercial and political relations between enemy states cease on the day a state of war is declared. The treatment to be accorded to combatants of an enemy state is clearly defined by international law and custom. The position of non-combatants is not so definite. Previous to the War of the Nations it was customary to allow citizens of a hostile state residing in another state to continue their peaceful occupations on the principle that only the armed forces were at enmity. During that unparalleled conflict, however, usual precedents were ignored. Germans and Austrians in British or French possessions were made prisoners that they might not be tempted to act as spies or to return home to swell the ranks of the soldiery. Belgian noncombatants were deported by the Germans and in Germany were forced to work for their enemies. See WAR; INTERNATIONAL LAW.

ENERGY, *en'er ji,* the name given in physics to the capacity possessed by matter for doing work. Energy is one of the two fundamental ideas of physics, the other being matter itself. Motion, heat, light, sound and electricity are all energy expressed in different forms. See PHYSICS.

The great source of energy is the sun, and this *solar energy* has been accumulating since the beginning of time. On earth the energy originally derived from the sun which man is able to apply to his own purpose is stored up in coal, wood and oil; in food; in the tides and waterfalls and running streams; in the wind; in the muscular energy of the animal world, and in hundreds of other familiar forms. The process of transferring energy from one body to another is called *work,* and we measure work and energy by the same units.

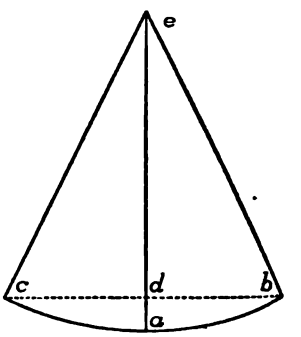
Types of Potential Energy. The two great divisions under which all energy is classified are *potential* and *kinetic,* and whatever is not one is the other. Energy which is slumbering or lying hidden is known as *potential energy,* or *energy of position.* Work has been done upon certain matter—that is, energy has been expended upon it—giving it in turn a power to work which is only awaiting the proper touch to become active. A locomotive under a full head of steam, waiting for the exact moment of departure; a boat held down by its anchor, its sails bulging with wind; a racehorse listening for the starting gun; a baseball in the pitcher's hand; a loaded gun; a boulder balanced on a hillside; a tightly-coiled spring; a hammer poised in air; a bent bow, ready to let fly its arrow, or a stretched elastic band of any kind; an unlighted match; a charged battery; a tank of gasoline, or a lump of coal—all these are examples of potential energy.

Types of Kinetic Energy. *Kinetic* comes from the Greek word meaning *move,* and kinetic energy is therefore the *energy of motion,* or energy which is in actual operation. The moving train; the boat in full sail; the horse speeding toward the tape; the ball or bullet flying through the air; the boulder rolling down to the foot of the hill; the uncoiling spring; the hammer striking the anvil, or the weight falling to earth; the bow or the elastic snapping back to its original shape; the burning match; the battery releasing its electrical charge in the form of a current; the gasoline or coal in combustion, giving life and power to the engine—these are all everyday illustrations of what we call kinetic energy.

The Constant Transformation of Energy. Every change that takes place in the universe results from the change of kinetic energy into potential, or potential into kinetic—a process called the *transformation of energy.* When a boy, for instance, puts a stone in the pocket of a slingshot and stretches the rubber, the stretching process develops kinetic energy transferred from the potential energy in the boy. This kinetic energy, in turn, becomes potential energy in the rubber band, so long as he holds it stretched. When he releases the band the potential energy is transformed into kinetic and is transmitted to the stone. When the stone hits, the energy is transferred to the object struck, once more becomes potential energy, and would reveal itself to our touch in the form of heat.

The Great Law of the Conservation of Energy. By the phrase *conservation of energy* is meant that the amount of energy in the universe is always the same, that it can neither be increased nor diminished. It can be directed, but it cannot be created or destroyed. It is *conserved*—kept. Thus, if energy disappears in one form, another form replaces it *in precisely the same amount.*

The pendulum is an example of the way in which energy changes and is conserved. When we draw the bob aside from *a* to *b,* as shown in the illustration, we are doing work upon it, for we are lifting it in space the distance *ad.* Thus we have stored up potential energy, which begins to change into kinetic the moment we let it drop, is wholly kinetic at *a,* and again wholly potential at *c,* but with the *total energy* always the same. The pendulum has raised itself through an arc (*ac*) equal in length to the arc through which it was lifted (*ab*); that is, it has put forth as much energy as was put into it—no more, no less. The pendulum would continue to swing back and forth forever, exchanging potential energy for kinetic, and vice versa, if it were not for friction and the resistance of the air. However, the energy used up in



MOVEMENT OF THE PENDULUM

Illustrating the transformation of energy.

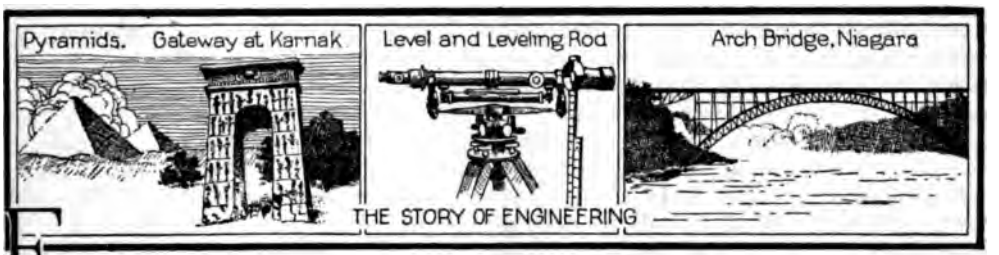
overcoming such friction is not lost; it simply appears in another form. This makes it obvious that for the pendulum to vibrate indefinitely would require a steady manufacture of energy; and since energy cannot be created, the old philosophers' dream of *perpetual motion* is impossible to realize. See PERPETUAL MOTION; PENDULUM. L.M.B.

ENGINE, *en'jin,* a name given to any skilfully constructed mechanism which is capable of converting energy into mechanical work. The name is now mostly applied to the steam engine, in which the force contained in the heat of the steam is transformed into mechanical energy in the form of motion which is then utilized for doing mechanical work. The steam engines, as well as the gas, oil and hot air engines, are known as heat engines, for all of them convert the power of heat into mechanical work. There are other engines from which mechanical work is obtained by utilizing the power of water, and these are known as *hydraulic* engines.

It is well to note the difference between an engine and a machine, however complicated or skilfully constructed the latter may be. An engine produces the motion, while a machine does its work by means of the motion or power which it receives from an engine.

Related Subjects. The reader is referred to the following articles in these volumes:

Energy	Machine
Gas Engines	Physics
Locomotive	Steam Engine



ENGINEERING, a term applied generally to the art or science of construction. A person who practices the art is called an *engineer,* though in former times that name was applied only to those who were engaged in the production of military weapons or defenses. In modern times engineering has become a highly specialized science, which may be roughly divided into *civil* and *military* branches.

The *civil engineer* accomplishes veritable miracles which the average man accepts as a matter of course, merely thankful that someone has devised things for his comfort and convenience. The engineer tunnels half a mile through a mountain and comes out on the other side within six inches of his objective point; he goes a hundred miles into a hilly region, builds great retaining dams and conducts pure, fresh water under ground, over valleys and beneath rivers and gives people in a great city 500,000,000 gallons of water a day; he builds a bridge 400 feet above a raging stream, without a single pier, and over it the traffic of a nation moves; he views a great arid region, discovers miles and miles away a plentiful water supply—maybe amid the eternal snows of the mountain tops—and brings it down to make that desert "blossom as the rose." Wherever civilization penetrates, the civil engineer is almost always an advance messenger to pave the way for home-making and the building of cities.

Military engineers adapt many of the arts of peace to the stern uses of war; they construct fortifications, trenches, bridges, pontoons, telegraph and telephone systems and other devices demanded by military necessity.

Modern engineers usually devote themselves to one branch of engineering; the field is so broad that no man could hope to excel in every branch. Electrical engineering demands special study of subjects of which the mining, irrigation, railroad construction or canal engineer need have no knowledge; each branch requires special preparation and special talent. An engineer who is thoroughly advised in all matters relating to mining might not make a success as engineer for a large irrigation project. Each branch of the art is specialized. This has been called an age of specialization, and nowhere is the truth of that more plainly seen than in engineering.

Among the most remarkable engineering feats of modern times are the construction of the Panama Canal, of the Assuan Dam on the

Nile, and of the reservoir for the supply of water to New York erected in the heart of the Catskill Mountains. In Canada the opening of the Canadian Northern Railroad from ocean to ocean in October, 1915, marked a triumph of engineering skill in railroad construction.

Engineering is one of the most ancient of arts and had been brought to a remarkable state of perfection among Eastern nations centuries before the birth of Christ. One of the greatest engineering feats of all time is seen in the building of the mighty Pyramids of Egypt. So perfectly were they planned and executed that the most delicate of modern engineering instruments and calculations fail to find an error in the theory or practice of their construction, and nobody has ever discovered how the mighty stones were raised to their lofty positions. The Romans left behind them striking monuments to their engineering skill in bridges, aqueducts and roads they built. Ancient Babylon, in its Hanging Gardens, possessed one of the wonders of the world.

Engineering Schools. The need for special education in engineering subjects was first recognized in France and Germany. Schools were established in France in 1747 and in Germany in 1824 for the purpose of training engineers for government service. This example was followed in the United States by the establishment of the West Point Military Academy in 1802; but little else was done in this direction until near the end of the War of Secession. Canada was even later in the field, but so thoroughly has the need of such training been realized that technical schools have been opened in connection with nearly every great university in North America, and many separate technical institutions have been established. The object of these schools is the same in all cases; they aim to give the student a thorough practical and theoretical grasp of that branch of engineering to which he wishes to devote himself. Entrance to the technical schools is gained by examination or by certificate from recognized high schools.

No young man should select any branch of engineering as a profession unless he has an aptitude for higher mathematics. Civil engineering, mining engineering and the like require good physique or ability to endure more or less exposure and hardship. To the boy who has a leaning towards constructive work and who is willing to prepare himself thoroughly, some branch of engineering offers high inducements.

Engineering Instruments. For their varied and delicate tasks engineers have need of many special instruments, some of them very complicated. A description of these is not possible here, nor is it necessary, but a more or less general statement as to the basic instruments in use will be helpful and interesting. The engineer must be able to measure distances accurately, to distinguish directions, to measure angles and to determine at any time whether a certain line or surface is absolutely horizontal, and for each of these processes he makes use of special instruments.

His commonest measuring instrument is the *chain,* made up of links of steel wire. The usual length of this is fifty or 100 feet. As it is subject to a slight variation in length with wear or with alteration in the shape of the links, it is used only for rough measurements.

The instrument used in determining directions is the *compass* (which see); that for measuring angles is the *transit* (which see). This last-named wonderful instrument is the basis of much of the engineer's most important work, and its invention made comparatively easy many computations impossible before. Another very useful instrument is the *level,* which shows with perfect accuracy whether or not a line is horizontal. E.D.F.

Related Subjects. Various phases of the general subject of engineering will appear clearer and more interesting if the reader will consult the following articles in these volumes. Lists of related subjects are also given with some of these articles:

Aqueduct	Irrigation
Assuan	Jetty
Breakwater	Levee
Bridge	Level
Caisson	Lighthouse
Canal	Lock
Cofferdam	Physics
Crane	Pier
Dam	Pyramids
Electricity	Reservoir
Engine	Steam Engine
Gearing	Strength of Materials
Hanging Gardens of Babylon	Surveying
Heliograph	Tunnel
Hydraulics	Turbine
Hydrostatics	Viaduct
	Well Boring

The following distinguished engineers are also given separate articles in these volumes:

Armstrong, William G.	Lesseps, Ferdinand de
Bessemer, Henry	Nasmyth, James
Eads, James Buchanan	Russell, John Scott
Eiffel, Gustave	Stephenson, George
Ericsson, John	Stephenson, Robert
Fulton, Robert	Stevenson, Robert
Goethals, George W.	

ENGLAND, called by Oliver Goldsmith the "land of scholars and the nurse of arms," is an island kingdom comparatively small in area, but in importance it is among the greatest countries of the world. It occupies the southern portion of the island of Great Britain, and is the chief member of the United Kingdom of Great Britain and Ireland. England's right to this distinction was emphasized by the American, Daniel Webster, in 1834 in these words:

* * * * a power which has dotted the surface of the whole globe with her possessions and military posts, whose morning drum-beat, following the sun, and keeping company with the hours, circles the earth with one continuous and unbroken strain of the martial airs.

Separated by the North Sea, the English Channel and the Strait of Dover from the continent of Europe to the east and south, it has been isolated enough to escape many of the disturbances which have torn the continental countries, but yet close enough to take advantage of every step the latter have made in progress and in government. Its people, moreover, have shown the characteristic island-dwellers' passion for freedom, and there exists nowhere to-day a more liberty-loving people than the English. The old name for England was *Albion,* meaning *white,* given because of the color of its chalk cliffs as seen from the sea.

The People. In every place to which civilization has penetrated, Englishmen are known, for they have never lost that adventurous spirit which led them in the fifteenth, sixteenth and seventeenth centuries to discover, explore and settle upon lands far beyond the seas. Wherever they may be found, Englishmen display many of the same qualities—they are independent, determined, progressive and possessed of decided executive ability and mechanical skill. While not so adaptable as some other peoples—the French, for instance—they have more of a genius for adapting to themselves those with whom they come in contact.

The English are not a pure race, in the sense in which the ancient Greeks were, for example. The history of their country, given below, makes it clear how several peoples, Britons, Angles, Saxons, Jutes and Normans, had a part in the making of the race. Their language, too—one of the most wonderful languages in the world—shows all of the same influences, and more. It is not possible to trace characteristics in detail, to say "From the Saxons came this trait, from the Normans this other," but the mingled strains are there. In another sense the population of England is remarkably pure, for there are comparatively few foreigners.

According to the latest statistics, England is the most densely-populated country in the world, with the exception of little Belgium; it had 34,045,290 inhabitants in 1912. Though the population of the United States has increased at about twice the rate of that of England, it will be many centuries before the former country is as thickly populated as the little island kingdom. In its large proportion of city to country inhabitants England leads the world, over seventy-eight per cent of the people living under city conditions. Just what effect the War of the Nations will have on the population of England, as regards birth-rate and living conditions, cannot for some years be predicted, but it may be said with certainty that it will be profound.

London, the capital of England, is the largest city in the world excepting, possibly, Greater New York, and it is the greatest commercial center. Besides this metropolis there are in England fifteen other cities or boroughs each with a population of more than 200,000. These are Birmingham, Liverpool, Manchester, Sheffield, Leeds, Bristol, West Ham, Bradford, Kingston-upon-Hull, Newcastle-upon-Tyne, Nottingham, Stoke-on-Trent, Salford, Portsmouth and Leicester. There are, in addition, twenty-five cities which have between 100,000 and 200,000 inhabitants each.

Religion. The history of religion in England

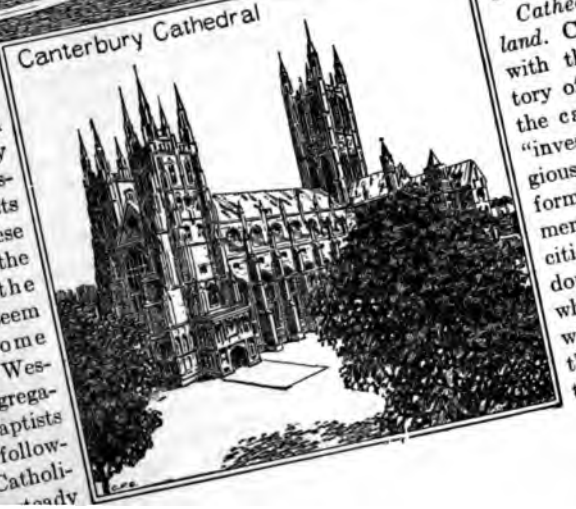
Magdalen Tower, Oxford

interest- nany of rtant po- as wars or ave had ning cause gious ques- e the days eth, Protes- as been the religion; no Catholic may e throne. The Church is the of England, ed Episcopal ; while correct

growth in the century, and to-day the number of its adherents is estimated at about 2,000,000. There are almost 200,000 Jews in the country, most of whom are merchants living in the large cities. Indeed, it would be difficult to name a faith which is not represented, for there is permitted perfect freedom of worship, even Mohammedanism having a number of adherents

Salisbury Cathedral

statistics are not available, it is estimated that this established faith has about as many members as all the dissenting Protestant sects together. Of all these dissenting bodies the Methodists are the strongest, as might seem natural in the home country of John Wesley, but the Congregationalists and Baptists also have large follow- Roman Catholi-


Canterbury Cathedral

and at lea mosque.

Cathedrals land. Closely with the rel tory of the the cathed "investment gious senti form the ment of cities an dom di who beg witness the cat tle to

e, was begun in 1083 and not fin- until 1534. This cathedral, one of the in England, is 530 feet in length, has r 170 feet in height and the only Gothic still in existence. Other of these great ctural triumphs are the cathedrals of bury, Exeter, Lichfield, Salisbury, Saint Wells and Lincoln; this last named choir which is called "one of the love- f human works." Most of these are ed in these volumes, either under their ames or in the articles on the cities in they are located. Various types of cture were used in the erection of these gs, and often minor structures, as cloi- refectories, were grouped about them. y the whole group, with an extensive anted open space in front of it, was sur- d by a high wall pierced with gates; f these enclosing walls still exist.

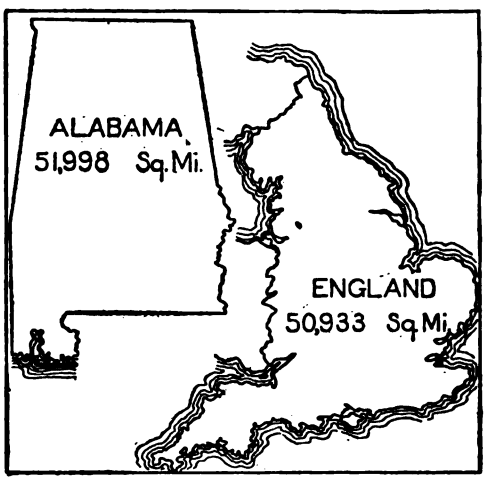
cation. Though England has always nterested in education, and the illiteracy tage stands at the comparatively low of 5.8, it is only in recent years that the ional system has been well organized. tion was for a long time too largely hands of various religious bodies, or ed societies, or private individuals, and vernment contented itself with bestow- l upon such schools as could prove their nd their worthiness. What many of the schools were like, Dickens showed in escription of Dotheboys' Hall, Mr. e's school, Dr. Blimber's select establish- and others, and there is no doubt that itings had a large influence in bringing a different state of affairs. The schools cribed might not be typical, but it was sable that any such places should exist, movement for the nationalizing of ele- y education was speedily set on foot. ICKENS, CHARLES, subhead *Influence on tion.*

e 1870 providing elementary instruction en a duty of the government. Local dis- support their own schools, but aid may ained from Parliament by poor districts. ional law makes education compulsory n the ages of five and fourteen, but are certain economic conditions which children from school attendance during t three years of that period.

ndary schools also are required by the al laws, but they are not so well or- d or managed as are the elementary s. The great "public" schools, as they are called, such as Eton and Rugby, to which most boys who can afford it are still sent for their secondary education, are not in reality public schools at all, but private schools at which tuition is charged. Secondary education is still largely of the classical type, but there is growing discontent with this. Educational leaders are striving to introduce science, commerce and industry into the schools generally.

At the summit of education in England, though not in any way a part of the national system, stand the great universities. In addition to the two oldest ones, Oxford and Cambridge, there are to-day eight others; these are London University, Durham University, Victoria University of Manchester, Birmingham University, Liverpool University, Leeds University, Sheffield University and Bristol University, the last-named founded no longer ago than 1909.

Interesting Measurements. This great country of England, with a history which all the world looks to as the very basis of constitutional government, with a literature which is second to none, with industries which are



COMPARATIVE AREAS

The text states that England is slightly larger than the state of New York. The pictorial comparison above emphasizes more strikingly the greatness of this very small country.

world-wide in their importance, is but little larger than the state of New York, for it has an area, exclusive of Wales, of only 50,933 square miles. Its population of 34,045,290, however, is almost four times that of New York state. The greatest breadth of the country, from Land's End on the extreme west to North Foreland on the east, is about 320 miles, while its greatest north-and-south length, from

h in the northeast to Saint Albans he south, is about 360 miles. In ountry is roughly triangular, narrow- d the north, where it is cut off land by the Solway Firth, the Cheviot . the River Tweed. It is not strange gland should have developed as a er, the real "ruler of the waves," when nsidered that no spot in the island is han seventy miles from the sea, when merous deep indentations and navigable are taken into consideration. England , without Scotland or Wales, has a coast which with all its irregularities measures st 2,000 miles, and portions of this shore are famous. Specially notable are the te chalk cliffs at Dover, visible from France, ich at this narrowest point of the English annel is but twenty-one miles distant. Poets ave always loved to sing of these steep shores, nd Matthew Arnold in one of his best-known oems has written how—

The cliffs of England stand,
Glimmering and vast, out in the tranquil bay.

To the west of England are the Irish Sea and Saint George's Channel, beyond which lies Ireland, the other island included in the United Kingdom.

Highlands and Lowlands. Wales is notably mountainous; so is Scotland, but England for the most part is low-lying. The Englishman who has never traveled beyond the borders of his own country can know nothing of towering mountains, snow-clad peaks, or valleys so deep that the sun seldom reaches them. Beautiful rolling downs he may know, picturesque hills, and valleys that slope steeply enough to turn their streams into rushing torrents, but that is all. The highest land in the country is in the north. Here is the so-called Pennine Chain, with its highest point, Cross Fell, 2,930 feet above sea level; and here, to the west of the Pennine Chain, the celebrated Lake District, famous for the exquisite beauty of the clear lakes which lie in its valleys. The greatest altitude in England is reached in Scafell Pike, 3,210 feet, in the Lake Region.

In the southwest there is another range of hills, lower than the northern ones, which runs out into the peninsula of Cornwall and Devonshire, and breaks off abruptly in steep cliffs at Land's End. To the east of this hilly region the southern portion of England is a coastal plain, not so flat as to be monotonous, but only by gentle undulations, and in few altitude of 500 feet above sea level. It is this southeastern plain r which has made it possible for Englan become a great agricultural country.

The history of England might have very different had it been a land of mou barriers. The conquerors, whether Rc Anglo-Saxon or Norman, would have foun conquest of the island much more diff that this is true is proved by the fact

THE CLIFFS OF DOVER

these successive invaders did not con their inroads into the mountainous regio Wales and Scotland, where those of th habitants who refused to submit had entre themselves. The absence of high mour too, which would have proved a bar tc munication, made it possible for Engl develop as one country, not as a series o disconnected states, as did Greece.

English Rivers. The rivers of En connection with its tides, have had a part in its history. They are not the rivers of great continents, but a them are navigable through a large p course and are thus of great comr portance. All around the coast th high, that at Bristol reaching th thirty feet, and because of this possible for certain cities which some distance from the seaboar great seaports. The most famous is London, on the short Thame well to the top among the con rivers of the world. Other e importance are the Ouse, th Tyne, the Wear and the Te there are the Severn, the long Britain, and the Mersey, whi the sea great freights from L manufacturing districts.

Climate. Considering it has a remarkably temperat

titude is, roughly speaking, that of Lab-
, it has little or none of the intense cold
at country. Its mild winters and cool
ıers it owes to the surrounding seas, and
ially to the Atlantic Ocean and the Gulf
m, from which blow those southwest winds
ı are warm enough in winter and cool
h in summer to exert an appreciable in-
e on the climate. Naturally the western
is most open to these influences, and the

ISH TYPES: VILLAGE AND TOWN

nes of temperature are less there
in the east.

January, the coldest month, the aver-
emperature of the whole country is
40°, and such temperatures as 10°
° below zero, which the resident in
ıterior regions of the United States and
ıa knows so well, are unknown. Nowhere
ıips prevented by ice from entering har-

In the hottest month, July, the greatest
is experienced in London and its vicinity,
ven this is not extreme, for its average is
4°; while the mean temperature for the
country in that month is 61°. One strik-
eculiarity of the climate is its dense fogs,
ı often roll in from the ocean and obscure
ky for days. "London fogs," these are
l, but it is not only in London that they
il, though they are heaviest there because
e city's smoke, which mixes with them.

It is an interesting fact that England as a whole averages just about half as many hours of sunshine in a year as does Italy. The fogs are not unpopular with all the people, for it is said that to them in large measure is due the clear complexions and beautiful coloring of English women.

As a whole, England has a plentiful rainfall, and nowhere is irrigation necessary for agriculture. The westerly winds, blowing against the western highlands, carry plenty of moisture, and in certain districts, as in the Lake Region and in Wales, the annual rainfall is over sixty inches. Throughout the west the amount falls in few places below thirty-five inches, but in the east it is hardly anywhere more than thirty

prevail, though they are heaviest there because Generally speaking, October is the wettest month, though this is not true for all parts of the country. Most parts of England have more or less snow, but the heavy snowstorms or blizzards which leave drifts several feet in depth do not occur.

Industries. Industrially, England is one of the most important countries in the world. To appreciate to the full its position in this respect, it is necessary to bear in mind constantly its small size. Despite this, however, it has great natural advantages—valuable minerals which make possible not only extensive mining opera-

anufactures as well; fertile soil, g waters which teem with fish. This should be noticed first, be- basic. England has no gold, no liamonds, but much of its wealth on its minerals, for it has in abun- se two essentials, iron and coal. In borhood of one city, Newcastle, coal ntiful that the expression "carrying Newcastle" has become proverbial as ig entirely foolish and unnecessary and in Lancashire and Yorkshire there ther extensive coal region. The total at mined each year in normal times is what in excess of 190,000,000 tons, more one-third as much as is produced in the ed States. If it is not the largest producer coal, however, England is the largest ex- ter, for its product does not have to be ried great distances before it reaches the sea. The iron, fortunately, occurs not far from ne coal, and is thus the more readily avail- ble. Only the United States and Germany produce more iron than does England, but so great is the demand for the metal that large quantities of it are imported, chiefly from Spain. Of the other metals, tin, which is pro- duced in considerable quantities in Cornwall and Devon, has a certain historic interest, be- cause of the fact that it drew to the island the very first traders—the Phoenicians, who visited it long before the ancient Romans turned their attention toward it.

Manufactures. These are very closely con- nected with the mining activities, and depend upon them almost entirely. Manufacturing is England's greatest industry, six times as many people being engaged in manufacturing as in agriculture. Naturally, the great manufactur- ing centers are near the coal and iron fields, and are thus to be found largely in the north. There are two great branches of the industry—the textile and the metal, and these are clearly localized. Of the textile industries, cotton manufacture is most important, and even the casual reader about England connects that with the city of Manchester, which is the largest center of this industry in the world. There is a very special reason why Manchester is well- fitted to cotton-spinning, for the drawing-out and spinning of cotton is impossible in a dry climate, and Manchester always has much moisture in its air. In Yorkshire, and especially and at Leeds, is centered the is second only to cot-

As the name Manchester suggests cotton manufacture, so do Birmingham and Sheffield suggest the metal industry. All kinds of metal work are produced in the former city, but in the latter the output is largely steel cutlery. Machinery, too, is made in great quantities at Leeds and at Manchester, while in Staf- fordshire and in Derbyshire much pottery is manufactured from the excellent clay produced in the neighborhood. An enumeration of all the smaller industries, very numerous as they are, is impossible; but even these, without the great ones, constitute, when taken together, an important factor in the manufactures of the world.

While climate, geographical position and mineral wealth may account in large measure for England's manufacturing supremacy, they alone would never have brought it about. It cannot, in fact, be understood without reference to the industry and the mechanical ingenuity of the English people; for it was from English- men that those great inventions came which revolutionized the industrial situation through- out the world—the power loom, the steam en- gine, the locomotive and the Bessemer process of making steel.

Agriculture. Though not primarily an agri- cultural country, England has the remarkably- large proportion of seventy-six per cent of its land under cultivation, while in some counties the ratio is as high as nine-tenths. The most advanced methods of cultivation are practiced, and this fact, together with the extensive use of fertilizers, keeps this long-cultivated land in a high state of fertility. Of the cereals, wheat, oats and barley are most extensively grown, and it is noteworthy that in some sec- tions the yield of wheat to the acre average nearly forty bushels. Green crops and roo crops for forage; hops, fruit, especially apple and garden vegetables, are largely raised, bu with all its fertile soil, its industry and its in tensive farming, England is compelled to im port large quantities of foodstuffs.

The system of land-tenure is different fro that of most countries. The great proporti of the land is in large estates, which are su divided into small farms and rented to tena farmers. This might, to an inhabitant of country where most owners farm their own land, give an impression of transience, but it is the custom for families to remain generation after generation on the same land until a feel- ing almost of ownership is developed. Every traveler in England tells of the beauty of its

rural scenery—its small, highly cultivated fields, its blossoming hedges, its vine-grown cottages and its beautiful trees. These scattered trees about the farmlands now in large measure take the place of the old luxuriant forests, for land is too valuable to be left heavily wooded.

Stock-Raising. Certain counties have so high a proportion of grazing land that they are popularly known as "grass counties," and there stock-raising is the most important branch of agriculture. Some of the English breeds of cattle, as Durham and Devonshire; of sheep, as Southdown and Cotswold; and of pigs, as Berkshire, are everywhere famous for their excellence. England is a very large importer of butter, largely from Denmark, for most of the milk produced is needed to supply the demands of the cities.

Fisheries. An island kingdom should have extensive fisheries, and England is noted for its fishing industry. Billingsgate, London, is the largest fish market in the world, and Billingsgate fish-wives are credited with a vocabulary all their own, so peculiarly rich in invective that the word *billingsgate* has been adopted throughout the world. Thither are sent the great catches of herring, haddock, cod, plaice and mackerel which are brought back by the fleets of ships that put out from Grimsby, Hull, Yarmouth, Lowestoft and other fishing centers.

Many of the fish are shipped alive, in tanks, and reach the market as fresh as when they left the sea. Literal fleets they are which bring in these fish, the number of vessels of every sort employed being in the neighborhood of 10,000. They do not confine themselves to the shores near home, but find their way northward to the Faroe Islands and Iceland, and southward to the coast of Portugal to bring home this only article of food which England has in sufficient quantities without importing any. At the outbreak of the War of the Nations in 1914 it became apparent that the fishing boats would run grave risks if they followed their customary routes, but because England needed the food-supply the fishermen quite generally ignored the danger and held to their tasks.

Other Information. For the transportation and communication, commerce, government and religion of England, consult the respective subtitles in the article GREAT BRITAIN. English art is discussed under the titles PAINTING and SCULPTURE; for the language and literature see ENGLISH LANGUAGE; ENGLISH LITERATURE, and the lists accompanying the latter topic.

History of England

In the Earliest Days. It is known that many, many centuries before there was any written record, there were people living in England, but they were not people whom the later inhabitants would be glad to claim as ancestors. Judged by the rough weapons and tools which they left, they were but the rudest sort of savages, dwelling in caves and living by hunting and fishing. But at length there came from the continent of Europe a very different race, the *Celts*, or Britons, who conquered the island and made it their home. They knew how to make instruments of bronze, instead of the stone implements of the savages, and how to till the soil; and it was not so very long before they discovered the use of that most valuable of the minerals, iron. They had a strange, weird religion, and their priests, the Druids, wielded a strong influence.

The Coming of the Romans. When in the course of his victories in Gaul Caesar came to the northern coast, he could see across the narrow channel the "white cliffs of Albion," and there was born in him the determination to cross over to the island and punish the people there who had been giving help to the Gauls against the Romans. In 55 B.C., therefore, the first Roman legions landed in Britain, and the recorded history of the country began. See CAESAR, CAIUS JULIUS.

Not until the time of Claudius, however, almost a century later, was there a serious attempt to reduce Britain to the condition of a Roman province, nor was the conquest really finished until the time of Agricola. Even then the whole island had not submitted, the people north of the Firth of Forth and River Clyde in Scotland never having come under the sway of the conquerors.

In some ways the period of Roman rule was of advantage to the southern part of the island, for the semi-barbarous Britons learned from their conquerors certain of the arts of civilization. Great roads, too, were constructed by the Romans, also flourishing towns, and certain little Briton villages were fortified and built up into cities which to the present day retain their importance as centers of population. One of these little villages the Britons called by a name which meant "Fort-on-the-pool"—Llyn-

din; but the Romans could not catch the curious pronunciation and called it *London*, the name which it bears to-day. Christianity also crept into the island, much to the disgust of the Roman conquerors, and martyrs to the new faith became numerous in Britain.

The Romans Withdraw. The Romans had made no effort to win the respect and the trust of the conquered Britons; they ruled by force, and made slaves of most of the natives. Oppressed and downtrodden for centuries, the Britons had lost the strength which once was theirs, and when in A. D. 410 the Roman troops were withdrawn from Britain to guard Italy against barbarian invasions, the Romanized part of the island was at the mercy of all *invaders*. The Scots and Picts came down from the north and spread such terror that the Britons called upon the Jutes to aid them. These sea-pirates needed no second invitation, but came, with the related Angles and Saxons, and overran the island. Their ravages were to the full as bad as those of the Scots and Picts, whom they drove back, for they slaughtered the Britons by thousands and reduced most of those who remained to slavery. Only by escaping into the mountain fastnesses of Wales did any of the Britons preserve their lives and their liberty. Strongest of these invading hordes were the Angles, and it was from them that the island finally got its name of *Angle-land*, or England.

These invaders were pagans, and it was for his battles against them that the famous Ar-

thur, the Christian king, lives in legend to this day. In 597 Pope Gregory, who had been attracted to some Anglo-Saxon slaves exposed in the market place in Rome and had vowed to carry Christianity to the land from which such beautiful youths came, sent Saint Augustine to Britain, and the religion which had centuries before gained a hold in the island but had been entirely rooted out, spread rapidly.

Beginnings of a Real Kingdom. The Angles and Saxons gradually divided the territory which they had conquered into seven small kingdoms, commonly known as the Heptarchy (which see). There came a time, near the beginning of the ninth century, when Egbert, king of Wessex, succeeded in making himself lord over all the seven kingdoms, and from 827 dates the foundation of the kingdom of England. There has been a kingdom of England now for almost eleven hundred years, and every king or queen, except six, in all that time has been a direct or indirect descendant of Egbert.

The early kings had no easy task, for they had not only to maintain the dominating power which Egbert had gained for them over the other little kingdoms, but to resist the constant inroads of the Danes, who had gradually gained a foothold on the island. When Alfred, the greatest of these early kings, came to the throne in 871, he found that the Danes had overrun a large portion of the country. Though he could not drive them out he reduced their power, confined them to the eastern part of the island and compelled them to acknowledge him as their overlord. His reign, in more than this one direction, meant much for the country, but his successors were often forced to contend with the Danes, who were constantly issuing from their special territory, Danelagh. A real advance in government was made during this reign, however, especially in the establishment of the Witenagemot, or council of the chief men of the kingdom. Theoretically the king undertook nothing of importance without consulting this council, but in reality a strong king could reign almost absolutely.

STATUE OF ALFRED

England Becomes Danish, then By 1013 the Danes—not those from the Danelagh, but fresh hordes from the mainland—had made themselves masters of the island, and four Danish kings, Sweyn, Canute, Harold and Hardecanute, ruled in succession. When Hardecanute died in 1042 English and Danes both besought Edward, the descendant of the English royal line, to accept the throne, and he reigned until 1066. This is one of the memorable dates in English history, for in that year Harold, chosen king to succeed Edward, was defeated at the Battle of Hastings by William of Normandy, and the Saxon period of rule in England came to a close. By Christmas William had brought a large part of the island into subjection, and on that day was crowned in London as "king of the English," but not until several years later was the complete subjugation of England accomplished. Gradually, through the centuries that followed, the conquering Normans and the conquered Saxons were assimilated into one people, the English.

Rulers of England. In a brief article it is impossible to give in detail each reign in the history of England. There will be emphasized here only the great movements—those which have had a lasting influence on the country. But every English ruler from the Norman Conquest is treated in these volumes, and a detailed view of English history may be gained from these articles:

Ruler.	Dates of Reign.
William I, the Conqueror	1066-1087
William II	1087-1100
Henry I	1100-1135
Stephen	1135-1154
Henry II	1154-1189
Richard I	1189-1199
John	1199-1216
Henry III	1216-1272
Edward I	1272-1307
Edward II	1307-1327
Edward III	1327-1377
Richard II	1377-1399
Henry IV	1399-1413
Henry V	1413-1422
Henry VI	1422-1461
Edward IV	1461-1483
Edward V	1483-1483
Richard III	1483-1485
Henry VII	1485-1509
Henry VIII	1509-1547
Edward VI	1547-1553
Mary	1553-1558
Elizabeth	1558-1603
James I (Stuart)	1603-1625
Charles I	1625-1649
(Commonwealth)	1649-1660
Charles II	1660-1685
James II	1685-1688
William III	1689-1702
Anne	1702-1714

:ing the reign of Anne, in 1707, the two :ries of England and Scotland were united :itutionally, and the title of the sovereign .me officially not *King of England* but *King Great Britain and Ireland*. The remaining ers of this list, therefore, bear that longer ie:

George I	1714-1727
George II	1727-1760
George III	1760-1820
George IV	1820-1830
William IV	1830-1837
Victoria	1837-1901
Edward VII	1901-1910
George V	1910-

Medieval England. Of that great system of society, feudalism, so characteristic of the Middle Ages, England had had more than a touch before the coming of William the Conqueror, but it was he who organized society systematically upon that basis; and throughout the centuries which followed the nobles in their controversies with the king were constantly striving to rid themselves of the obligations which feudalism forced upon them. The kings, on the other hand, made constant efforts to strengthen the power of the crown at the expense of the nobility. Much was gained by Henry I, the second ruler after the Conqueror, but during the war for the throne which followed his death the nobles and the clergy made themselves practically independent of the royal authority. See FEUDAL SYSTEM.

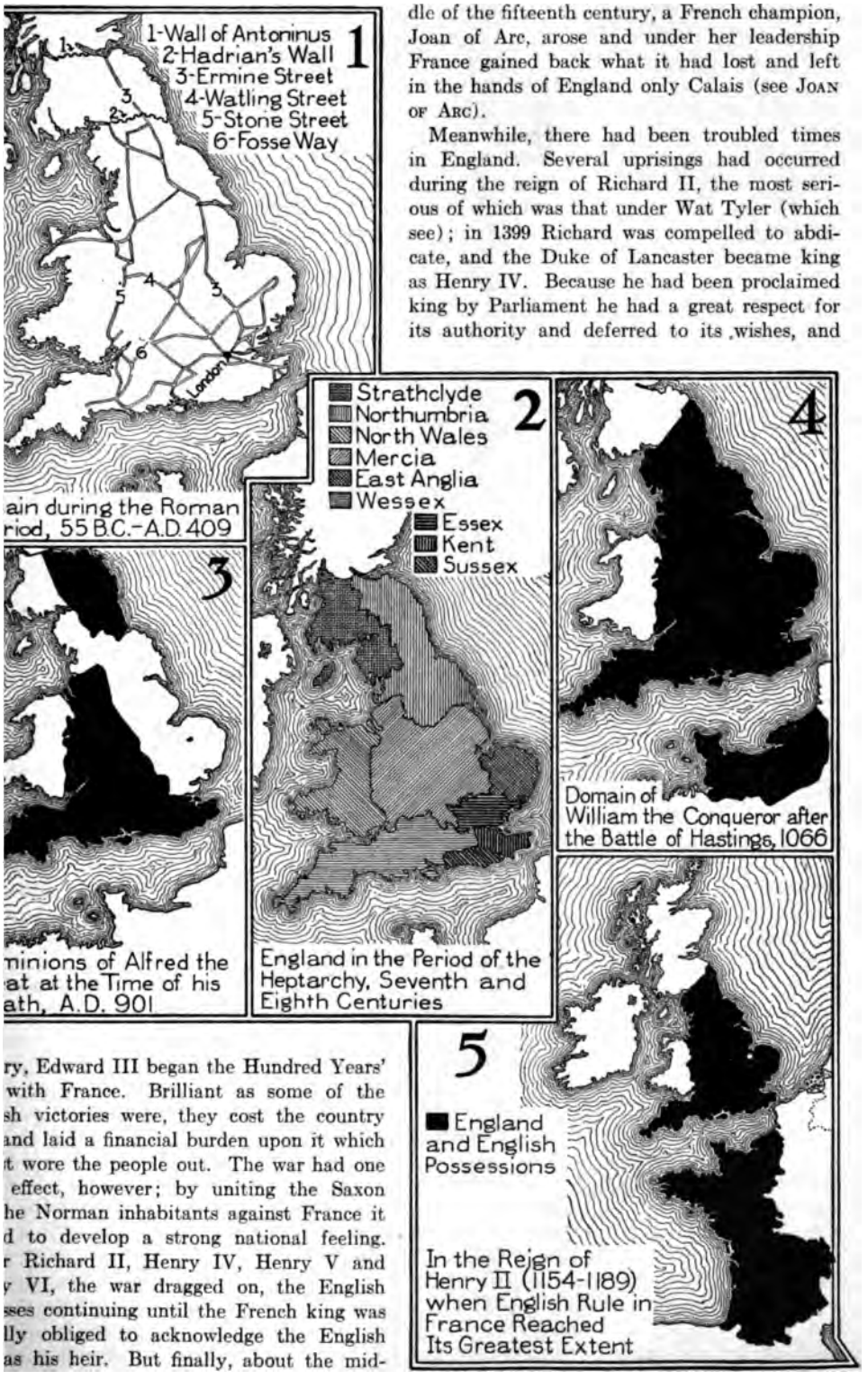
But in 1154, with the accession to the throne of Henry II, one of the strongest of English kings, the power of the great barons began to wane. Henry found time to establish a just and orderly government and to force the kings of Ireland and Scotland to acknowledge him as their overlord, despite the fact that he spent less of his time in England than he did in France, for his continental territories were more extensive than his island possessions. An outstanding event of his reign was the contest with the Church which ended tragically for Thomas à Becket (which see). Under Richard I much of the sovereign power was again lost, for Richard was interested only in the Crusades and spent less than a year of his reign in his kingdom. He was only too willing, also, to grant privileges to the barons in return for funds to equip his crusading expeditions. He managed to hold on to most of his possessions in France, but these were almost entirely lost during the reign of his brother, the untrustworthy, tyrannical John. Out of the very weak- ... however, came good to the country, for the barons were able in June, ... to wrest from him that famous docume known as the Magna Charta, that "foundati stone of English liberties," as it is called. U der Henry III this "Great Charter" was co

(*a*, *a*) Alfred's territory at its greatest extent

firmed, and a further step in the direction constitutional liberty was taken by the as bling of the first House of Commons, in 12

Wars with Scotland and France. These kings had been compelled in spite of wishes to grant to the country certain lib but Edward I, who came to the throne i showed himself quite willing to rule in ance with Magna Charta. His love f indeed, won him the title of "The Justinian," an honorable recognition great Roman law-giver. It was d reign that Wales was united with En that the title of Prince of Wales wa stowed on the heir to the throne reign, too, began a fierce struggle land which raged at intervals for ce involved the famous patriots Willi and Robert Bruce. Edward I ga advantages, but these were all lost successor, Edward II, who after t Battle of Bannockburn in 1314 w to acknowledge the independenc

Partly because France had s in this contest and partly bec claims which he held to ter



dle of the fifteenth century, a French champion, Joan of Arc, arose and under her leadership France gained back what it had lost and left in the hands of England only Calais (see JOAN OF ARC).

Meanwhile, there had been troubled times in England. Several uprisings had occurred during the reign of Richard II, the most serious of which was that under Wat Tyler (which see); in 1399 Richard was compelled to abdicate, and the Duke of Lancaster became king as Henry IV. Because he had been proclaimed king by Parliament he had a great respect for its authority and deferred to its wishes, and

ry, Edward III began the Hundred Years' with France. Brilliant as some of the sh victories were, they cost the country and laid a financial burden upon it which t wore the people out. The war had one effect, however; by uniting the Saxon he Norman inhabitants against France it d to develop a strong national feeling. r Richard II, Henry IV, Henry V and y VI, the war dragged on, the English sses continuing until the French king was lly obliged to acknowledge the English as his heir. But finally, about the mid-

that meant another step in the direction of constitutional liberty.

Wars of the Roses. Henry VI, who came to the throne in 1422, was a feeble ruler, utterly incapable mentally, and other claimants to the throne arose. Out of the opposing claims grew a long factional struggle known as the Wars of the Roses (see ROSES, WARS OF THE), in which Henry VI was several times dethroned, only to be again placed on the throne by the next victory of his adherents. In the end, however, the Duke of York gained the upper hand, and in 1461 was made king as Edward IV, and in 1483 his young son succeeded him as Edward V. Richard III usurped the power almost immediately, but after a very short reign was overthrown on Bosworth Field in 1485, while the Earl of Richmond, who united in himself the claims of the houses of Lancaster and York, was crowned king as Henry VII. The long wars had had a profound effect on the country. Most of the barons, the old questioners of the king's authority, had been killed off in the conflict, and their powers had been taken over by the king. Henry VII was strong enough to make the most of this advantage, and Henry VIII, when he came to the throne in 1509, found himself in possession of great power.

The Religious Struggle. The Tudors, of whom Henry VII was the first, were distinguished for their absolute rule, but though they were despotic they were not unpopular, for they made England glorious in the eyes of the world (see TUDOR). It was during the reign of Henry VIII that the Reformation had its beginnings in England, not because Henry was intensely interested in religion or desired to found a new system, but because the Pope would not grant him a divorce from his wife, Catharine of Aragon. As a result he had himself declared supreme head of the Church in England, and enriched himself by seizing the riches of the monasteries.

Henry's son, Edward VI, carried on the work of the Reformation during his short reign, but under the unfortunate "Bloody Mary," who has been more hated than she really deserves, there was a reaction, and many illustrious Protestants fell victims to her fervor for the Catholic faith. Her work was undone, however, by her great sister, Elizabeth, who had herself proclaimed head of the Church, but kept herself and her government free from religious fanaticism. The long reign of Elizabeth was one of the most glorious in all *England's history*. In literature, in science, in discovery, the period was noteworthy, while an intense feeling of nationality was developed by the defeat of the Great Armada. It was during her reign that Ireland was reduced to dependence on England.

The Stuarts and the "Divine Right." Elizabeth had never married, and the House of Tudor died with her. Her successor was James VI of Scotland, son of the ill-starred Mary, Queen of Scots, who became king of England as James I. The two countries, though now under one sovereign, were not completely united, however, for over a hundred years. James was a firm believer in the "divine right of kings" (which see), and this doctrine brought him into constant conflict with Parliament and marked the beginning of that struggle which ended so disastrously for Charles I. This reign is a starting-point in the history of America, for during it were founded the Jamestown and Plymouth colonies.

The reign of Charles I was almost entirely taken up with a conflict with Parliament which finally resulted in open war. Forced to assent to the Petition of Right, another of those milestones which mark the Englishman's march toward constitutional liberty, he disregarded it, dismissed Parliament and for eleven years ruled arbitrarily, without assembling another. Then followed the Long Parliament, the Civil War, the execution of the king in 1649 and the gradual emergence of Cromwell as the strongest man in Parliament and in the army. Under the Commonwealth, with Cromwell at its head, the country held a position of respect in the eyes of the world, but Cromwell's son Richard proved a weak successor, and in 1660 the royalists brought about the restoration of Charles II. All the arbitrary powers which their predecessors had fought to keep Charles I from gaining, a complacent Parliament almost thrust into the hands of Charles II, who showed himself willing enough to make use of them. It was one of the reigns upon which no Englishman can look with pride. As concerned its foreign policy, England was little more than a dependency of France, which was the instigator of two wars with Holland which cost England much and gained for it nothing; in character it was licentious, the literature of the period reflecting with painful clearness the immorality of the court and of society; but all of this the people submitted to because of their pleasure that the severities of Cromwell's time were over, and that a king of the royal line was again on the throne.

he brother of Charles II, and his heir, was acknowledged Catholic, and attempts were le to exclude him from the succession, but vain. In 1485 James came to the throne, from the first his favoritism for Catholics as pronounced as the people had feared it ht be. He set aside the Test Act and gave itions of trust and honor to Catholics, and even went so far as to gather an army with ch to carry out his plans. So long as it med that his line would die out with him, people bore with his tyranny and the illeity of his acts, but when a son was born to in 1688, and it became evident that there ht be a Catholic succession, several of the at nobles dispatched an invitation to Wiln of Orange and his wife Mary, the son-in- and daughter of James, to seize the Eng throne. They came late in 1688, James l, and the "bloodless revolution" was accomhed without striking a blow.

he Responsible Ministry. William and ry were made joint sovereigns, but William the real ruler. He was never popular, bese he was looked upon as a foreigner, but endured his unpopularity in silence, and e the country a wise and just government. its foreign relations England was now opd to France, which was still under the rule hat old tyrant who had been William's ay for so many years, Louis XIV, "the d Monarch." But the most significant ments of the reign were domestic rather foreign. The Dissenters, who in the prereigns had been persecuted, at times bitvere allowed freedom of worship, and the a responsible ministry became firmly esd. Hitherto, the kings had chosen or d their ministers as they saw fit, but ow declared that all Cabinet ministers onsible to Parliament, and could hold y during such time as the party to y belonged was in the ascendancy in

illiam died in 1702, Anne, the sister ame to the throne. She was well- , though rather dull, but her reign brilliant by the successes of her l, Marlborough, in the war against (see SUCCESSION WARS, subhead *panish Succession*). In literature, n was noteworthy, Pope, Swift, thers reflecting such glory upon it monly known as the Augustan while Anne was on the throne. he actual legislative union of Scotland with England, begun a century e when one sovereign came to reign over two countries, was at length accomplis Scotland sent its members to the English l liament and save in local affairs ceased to h a separate government.

From that date, the United Kingdom bc the name of Great Britain. The history England since the union is continued in th article GREAT BRITAIN. A.MC C.

Consult Macaulay's *History of England;* Montgomery's *History of England;* Greene's *History of the English People;* Andrews' *A History of England.*

Related Subjects. The articles in these volumes which deal with some phase of English life or history are numerous. The following classified list will make them easily accessible:

CITIES AND TOWNS

Aldershot	Lincoln
Birmingham	Liverpool
Blackburn	London
Bolton	Manchester
Bradford	Middlesbrough
Brighton	Newcastle-upon-Tyne
Bristol	Northampton
Canterbury	Norwich
Chester	Nottingham
Coventry	Oldham
Derby	Oxford
Dover	Plymouth
Exeter	Portsmouth
Gloucester	Preston
Greenwich	Sheffield
Halifax	Southampton
Huddersfield	Stratford-on-Avon
Hull	Sunderland
Kenilworth	Yarmouth
Leeds	York
Leicester	

EDUCATION

Cambridge, University of	Oxford University
Eton College	Rugby School

HISTORY

For later history, see list of *Related Subjects* under GREAT BRITAIN.

Agincourt	Grand Remonstrance
Aix-la-Chapelle, Congress of	Gunpowder Plot
Aix-la-Chapelle, Treaties of	Hampton Court Conference
Anglo-Saxons	Hastings, Battle of
Armada	Heptarchy
Bannockburn	Hundred Years' War
Barebones Parliament	Lancaster, House of
Boyne, Battle of the	Long Parliament
Cavaliers	Magna Charta
Commonwealth of England	Marston Moor
Crecy	Naseby, Battle of
Crusades	Normans
Domesday Book	Petition of Right
Feudal System	Picts
Field of the Cloth of Gold	Plantagenet
Flodden Field	Plymouth Colony
	Plymouth Company
	Reformation, The
	Renaissance

OUTLINE AND QUESTIONS ON ENGLAND

Outline

I. Location and Size

(1) Latitude, about the same as that of Labrador
(2) Longitude
  (a) Meridian of Greenwich
(3) Situation with relation to Continent
  (a) Dividing waters
(4) Actual size
  (a) Greatest length, 360 miles
  (b) Greatest breadth, 320 miles
  (c) Area, 50,933 square miles
(5) Comparative size

II. Physical Features

(1) Coast
  (a) Length
  (b) Character
(2) Surface characteristics
  (a) Absence of mountains
  (b) Highest hills
  (c) The fertile plain region
  (d) Effect of surface features on history
(3) Rivers
  (a) Shortness
  (b) Great commercial importance
(4) Lakes

III. Climate

(1) Comparatively even character
  (a) Reasons for lack of extremes
(2) Abundant rainfall
(3) The characteristic fogs

IV. The People

(1) Characteristics which have made them powerful
(2) Racial strains
(3) Density of population
  (a) Most densely populated country
(4) Rural and urban proportion
(5) Great cities
(6) Religion
  (a) The State Church
  (b) Other denominations
  (c) The great cathedrals
(7) Education
  (a) Recent organization
    1. The influence of Dickens
  (b) Elementary schools
  (c) Secondary schools
  (d) The universities

V. Industries

(1) Manufacturing—the chief industry
  (a) Reasons for preëminence
  (b) Chief centers
  (c) Important products
    1. Textiles
    2. Metal goods
(2) Mining
  (a) Coal
  (b) Iron
  (c) Close relation to manufacturing
(3) Agriculture
  (a) Proportion of land cultivated
  (b) Chief crops
  (c) System of land-tenure
  (d) Stock-raising
(4) Fisheries
  (a) Location
  (b) Catch
  (c) Only foodstuff not imported

VI. History

(1) The beginnings
  (a) Earliest inhabitants
  (b) The Celts
(2) The Roman occupation
  (a) Julius Caesar
  (b) Later generals
  (c) Impress on the country
(3) Invading hordes
  (a) Scots and Picts
  (b) Jutes, Angles and Saxons
(4) Introduction of Christianity
(5) The Heptarchy
(6) The first king of England
(7) Struggle with the Danes
  (a) Alfred the Great
(8) The Norman Conquest
  (a) William the Conqueror
(9) Feudalism
(10) Conflict with the Church
(11) Magna Charta
(12) Hundred Years' War
(13) Conflict with Scotland
(14) Wars of the Roses
(15) The Reformation in England
  (a) Henry VIII
  (b) Edward VI
  (c) Mary
  (d) Elizabeth
    1. Firm establishment of Protestantism
(16) King and Parliament
  (a) The "divine right of kings"
  (b) Civil War
  (c) The Commonwealth
  (d) Restoration
(17) Establishment of responsible government
(18) Union with Scotland

See GREAT BRITAIN

Questions

What are England's great "investments in religious sentiment"? Describe two of them.

What effect has the absence of mountain barriers had on the history of England?

How many countries produce more iron?

What does the expression "He has a *billingsgate vocabulary* mean?

What was the Witenagemot, and what part did it play in the government of the country?

How did the Wars of the Roses affect the royal power?

What men helped to make famous the reign of Queen Anne?

What is the origin of the phrase "carrying coals to Newcastle"?

Why does a country which has so many dairy cows need to import such large quantities of butter?

What does "responsible government" mean, and when was it established in England?

How many cities has England which are larger than Des Moines, Ia.? How many has the United States?

How many peaks as tall as the highest in England would have to be piled on top of each other to equal the loftiest point in Canada?

Why does not the system of land-holding create the effect of transcience?

Who was the original missionary to England? By whom was he sent?

What was the good effect in England of the Hundred Years' War? The evil effect?

When did the birth of a baby boy bring about a revolution?

How many inhabitants would Canada have if it were as densely settled as is England?

What peculiar physical feature gave the island one of its former names?

How can land which has been so long cultivated still yield such large returns?

What does the name *England* mean?

Who was the "English Justinian," and why was he so called?

Name three languages which have strongly affected the English tongue.

How does one of the great universities of England differ from an American university?

Why does not England have as cold winters as that part of North America which is most nearly in its latitude?

Name four great industrial inventions which the world owes to the island kingdom.

What was the "Fort-on-the-pool"? How does it rank among the world's cities to-day?

What is the "foundation stone of English liberties," and why is it so called?

What is meant by the "divine right of kings," and when did it cause a civil war?

What quality have the English which makes up for their lack of adaptability?

What does the name *Sheffield* suggest? How does it rank among the world's cities as to its chief product?

Did the Romans ever conquer the entire island?

What was feudalism? Trace briefly its history in England.

Why was the reign of Elizabeth one of the most illustrious in all history?

How has England's island situation been of benefit to it?

What author, generally thought of as a novelist only, had a profound influence on education in England and elsewhere?

When did a great religious revolution grow out of a king's desire for a divorce?

	Ryswick, Treaty of
s of the	Self-denying Ordinance
s	Star Chamber
lament	Tudor
e	Witenagemot
se Plot	York, House of

ographies of the rulers, soldiers and n of England contain much historical The rulers since the Norman Conquest ed in the article above; the following e the soldiers and statesmen who were ent during the English period, and under BRITAIN is given a list of those who have nistory during the later period.

Early Rulers

d the Great	Ethelwulf
ur	Hardecanute
lstan	Harold
ute	William I, the Conqueror
ert	
elred II	

Soldiers and Statesmen

ltimore, Lord	Monmouth, Duke of
rkeley, Sir William	Montfort, Simon de
larendon, Earl of	More, Sir Thomas
romwell, Oliver	Pym, John
romwell, Thomas	Raleigh, Sir Walter
Delaware, Lord	Rupert, Prince
Edward, the Black Prince	Sidney, Sir Philip
	Strafford, Earl of
Hampden, John	Tyler, Wat
Monk, George	Wolsey, Cardinal

LEADING PRODUCTS

Apple	Iron
Cattle	Sheep
Coal	Tin
Fish	Wheat
Hog	

RIVERS

Avon	Severn
Humber	Thames
Mersey	Trent

UNCLASSIFIED

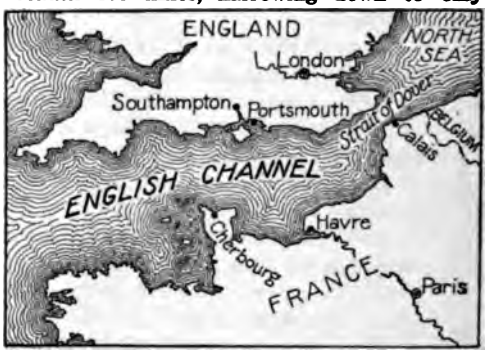
Birkenhead	Spithead
Church of England	Stonehenge
English Language	Tower of London
English Literature	Windermere
Land's End	

ENGLEWOOD, N. J., an attractive residential city in Bergen County, in the northeastern part of the state. It is sixteen miles west of New York City, fifteen miles north of Jersey City and twenty-three miles northeast of Newark, and is served by a branch line of the Erie Railroad. The population in 1910 was 9,924 and in 1916 it was 12,231. The area of the city exceeds five square miles.

Englewood is situated on westward-sloping land, one mile from the Palisades of the Hudson River. The city has fine parks and drives and beautiful residences, two summer homes for working girls, a $200,000 high school, a hospital and a library. There are no important ...terprises. Many New York busi... ...ome.

In 1871 the township of Englewood w... off from the township of Hackensack, and Englewood was incorporated as a city in 1895. This act of incorporation was declared unconstitutional, and the city was reincorporated in 1899. C.W.U.

ENGLISH CHANNEL, called by the French *La Manche,* meaning *the sleeve,* is an arm of the sea separating France and England. Its length is about 350 miles and its extreme breadth 100 miles, narrowing down to only



twenty miles at Dover. On the English side it extends from the Scilly Isles to Dover; on the French, from Ushant to Calais. It is of comparatively recent formation, as geological time is reckoned, for it is well established that England and France were formerly connected by land. The channel is the greatest commercial highway in the world, with the ports of Falmouth, Plymouth, Southampton, Portsmouth, Brighton and Dover on the English coast, and Cherbourg, Havre, Dieppe, Boulogne and Calais in France. It is also the highway for the vast commerce eastward to the Scandinavian countries and to Germany. It is noted for the roughness of its waters, due to the conflicting currents between the North Sea and the Atlantic Ocean and its frequent winter storms. The Channel Islands, a few miles off the French coast, and the Isle of Wight, are its principal islands.

There have been many schemes devised for building a tunnel underneath the Channel to connect France and England. The proposed route was from a point near Dover to Calais, and nearly one-third of the work was accomplished. Chiefly for military reasons it was vigorously opposed, and in 1883 the British Parliament decided definitely that it was not advisable to open submarine connections with France. Had the tunnel been completed it would undoubtedly have saved lives and money to Great Britain when it became neces-

sary to transport troops to France during the War of the Nations, which began in 1914.

ENGLISH LANGUAGE. The familiar saying that the sun never sets on England's possessions could truthfully be applied to the people who use the language developed in England, for this tongue is spoken throughout the British Empire. It is also the national language of the United States of America. It is estimated that it is spoken by over one hundred fifty millions of the human race. Among the languages of the world, the English is unique in that it is the most composite of them all. From the beginning of its history it has shown a peculiar readiness to take up and make its own many words and forms from other languages, and in none other do foreign terms play so important a part. Dr. Frank H. Vizetelly, in his history of the English language, has expressed this thought in these picturesque words:

> As the land of the Angles developed so the speech of the people grew, and he who wishes to seek that growth must be prepared to traverse the globe. From Scandinavian fiords, he must sail to the shores of Denmark and, journeying over these, must cross the frontier and penetrate the very fastnesses of the German Fatherland. Next his steps must turn to the flowery fields of France whence came the Norman conqueror, and, sauntering along its leafy highways, learn from his surroundings that the noble spires which dot this land, have their very counterpart in the cradle of the English tongue. Even here his journey is far from ended. From the shores of sunny Spain to the lands of the Great White Czar; from the Crescent City on the Golden Horn to the coral strands of India; from the land of the Ibis and the Lotus to the sun-baked veldt of the African Union; from the golden shores of Australia to the fertile fields of New Zealand; from the Land of the Rising Sun to the Land of the Morning Calm; from the Flowery Land of China to the dreary Siberian steppes—from each, from every one has English speech drawn tribute.

This language has been aptly compared to a mighty oak tree, the trunk and bare branches representing the native language forms, which give the tongue its simplicity, directness and force, and the leaves and blossoms representing the foreign element, which gives grace, variety and ornament to the speech. Because of this admirable blending of the native and foreign elements, the English language is unsurpassed in its possibilities for richness, power and variety of expression. No harmony or sweetness or elevation of language is beyond its scope; it has proved a worthy medium for such world-famous writers as Shakespeare and Milton.

History. The English language belongs to the Teutonic branch of the Indo-European family. It is a subdivision of Low German, which in turn is a division of the West Germanic branch of the Teutonic group. It is customary to divide the development of the language into three periods, Anglo-Saxon, or Old English (449-1066), Middle English (1066-1500) and Modern English, from 1500 to the present. The year 449 marked the invasion of Britain (England) by the first of those Teutonic (Low German) tribes who overran the island in the fifth and sixth centuries (see ANGLO-SAXONS). These hardy invaders found in Britain a race of people who spoke a Celtic dialect; the latter, after 150 years of incessant fighting, were driven into Wales and Cornwall. The conquerors' speech, tc which the name Anglo-Saxon is usually given, became the language of the country and the foundation upon which modern English is built. The name *Old English,* preferred by modern scholars, is synonymous with Anglo-Saxon.

During the centuries before the Norman Conquest (1066), which closes the early period, many new words were added to the native vocabulary. A few of these were taken from the speech of the Celtic tribes. In the sixth century came Saint Augustine to convert the people to Roman Christianity, and as a result a number of Latin terms and grammatical forms were adopted. *Altar, mass* and *psalm* are among the words of Latin origin introduced at this time. A second important influence was the Danish conquest of the island, through which a considerable Scandinavian element was added to the vocabulary. Four distinct dialects were spoken—Kentish, Mercian, Northumbrian and West Saxon; the Northumbrian was the form used by three of the most important of the early writers, Bede, Caedmon and Cynewulf; West Saxon was the literary medium used by Alfred the Great in his translations, and by the writers of the first history of the English people in their native tongue, the *Anglo-Saxon Chronicle.*

While the Anglo-Saxon vocabulary furnished the bony framework for the Modern English vocabulary, grammatically Old English had many points of difference. There were many more inflections than at the present time, for nouns, pronouns and adjectives had complicated declension systems. Gender, too, was fixed by arbitrary rule and not by meaning, *woman* and *maiden* being neuter, *hand,* feminine, and *foot,* masculine. In general, Anglo-

Saxon grammar was far more complicated than English grammar of to-day. The change has been very gradual.

The Middle English period began with the conquest of England by William, Duke of Normandy, who broke the power of Harold, last of the Saxon kings, at the memorable Battle of Hastings, in 1066. For two centuries after that time French was the language of the upper classes, of the law courts and of the schools, but English lived on the lips of the conquered people, holding its own as the speech of common life and finally becoming the dominant language of the kingdom. About 1250 the two languages began to merge, English absorbing almost the entire body of French words brought in by the Norman conquerors, and becoming thereby more expressive.

Then a Middle English literature began to develop. Three pronounced dialects were spoken, the Northern, Midland and Southern, but the Midland was given outstanding literary prominence because it was used by Geoffrey Chaucer, England's first great poet. Through his genius it became the standard form of the tongue and the parent of the Modern English literary language. During this period great advance was made in the simplifying of grammatical forms, a tendency that is still noticeable.

With the opening of the sixteenth century began the development of Modern English, and since that time the borrowing and assimilation of foreign words have gone on continuously. With the Revival of Learning (see RENAISSANCE) came a considerable body of Latin, Greek and Italian words. Through literary, political and commercial relations with other nations, and as a result of their colonization of lands in every section of the globe, the English people have made wonderful additions to their vocabulary. From the North American Indians they have adopted such words as *moccasin, tomahawk* and *wigwam;* from the West Indies have come *canoe* and *hurricane;* Mexico has contributed *chocolate* and *tomato; canary* and *guinea* are taken from African tribes; Australia has lent *boomerang* and *kangaroo;* China, *tea* and *nankeen;* the Malays, *bamboo* and *gutta-percha;* the Persians, *bazaar* and *caravan,* and so on. Science and invention have also made their contributions to the language; such terms as *hectograph, automobile* and *motorcycle* have come into use as new words, coined to meet new conditions.

The number of words in the English language at the present time is variously estimated by authorities. Dr. Vizetelly, managing editor of the *New Standard Dictionary,* said that in 1917 the total number of words in the English language, including radicals, derivatives, participles, obsoletes and foreign terms, was about 600,000. See SLANG; also DICTIONARY, for suggestions as to word study.

Suggestions for Study. The principles of correct English in writing and in speaking are laid down in the science grammar. Therefore to master the language one must understand the fundamental laws of grammar. The memorizing of a system of rules is not, however, the essence of language study. Many a pupil who can repeat correctly the rule that a verb agrees with its subject in number has used such an expression as *they was* in familiar conversation, and never thought of the rule. Grammar is essentially the science of relationships, and unless the student sees clearly the logical relation that the words of a sentence have to one another his memorizing of rules will avail him little. In the article GRAMMAR in these volumes will be found a comprehensive discussion of this phase of language study and a list of related subjects. All of the important topics connected with grammar, such as case, conjugation, gender, number, etc., are given complete treatment under appropriate headings.

The study of masterpieces of English and American literature is also essential. In the *Autobiography* of Benjamin Franklin we read that this pioneer in American literature gave himself devotedly to the study of Addison's *Spectator* essays, in order to perfect his own style, and Robert Louis Stevenson testifies that he achieved his eminence as a writer by studying the masterpieces and trying to imitate them. Each of the great English and American writers has something to impart to the student, and the study of the classics is therefore of supreme importance. Addison, Goldsmith, Lamb, Irving and Thackeray all wrote with grace, ease and clearness; Ruskin and De Quincey achieved a style which combines the best elements of both prose and poetry; Macaulay should be studied for his striking phrases and his effective use of contrast and balance in the construction of his sentences. These are but a few of a great host of writers whose works are truly a rich storehouse for the student. See ENGLISH LITERATURE; AMERICAN LITERATURE. B.M.W.

NGLISH LITERATURE, one of the 's greatest literatures. In every branch iting—in the essay, the drama, the novel, ic and lyric poetry—it has great master- , and one may read from childhood to ge without exhausting its riches. Of the and interesting history of its development possible to give here only a brief sketch, his is so planned that it will serve as a for more extensive reading in these vol- . Each branch of literature is treated un- ts own title, and the important authors ioned in this sketch are the subjects of l articles. It is thus possible, by read- ie discussion of a certain period here given he supplementary articles on the writers ioned, to gain a clear idea of what the l stood for.

thorities differ in their method of divid- he literary history of England into pe- but the classification here followed is of the best known.

The Anglo-Saxon Period (450-1050). There orks in English literature which an Eng- an cannot read, for the earliest are writ- a language, known as *Anglo-Saxon*, which st sight is altogether different from Mod- English. Literature was not at first *writ-* it was *sung* by the minstrels, or gleemen, they were called upon to encourage those into battle or to praise the popular s. Only gradually arose the custom of ig down such songs, that they might be rved. Of this early Anglo-Saxon poetry reat monument is the long poem *Beowulf* h see); it was probably written down the beginning of the eighth century. epic really originated in continental Eu- but about the year 670 a poem was com- l which was really English in its concep- -Caedmon's *Paraphrase*, a metrical ver- of parts of the Scriptures. This, too, is nglo-Saxon, and a person who has not a study of that can read Caedmon only translation. Other writers of note were the Venerable Bede, who wrote an *Ecclesiastical History*, and King Alfred, known as the "Father of English Prose." Foremost among the prose works of this period stands the *Anglo-Saxon Chronicle*, the earliest history produced in their own tongue by any Teutonic people.

II. **The Anglo-Norman Period** (1066-1350). The Norman Conquest of England in 1066 began a new era in literature as well as in history. The chief interest in the works produced for three centuries after this date centers not in the thought but in the gradually changing medium of expression—the language which was slowly shaping itself out of the French, Latin and Anglo-Saxon. Real literary development was slow, but about the year 1200 there was written a poem of genuine imaginative power—the rhyming chronicle of Layamon, known as the *Brut*. Metrical romances in cycles, such rhyming chronicles as the *Brut*, and religious poems were the favorite forms of literature, but new forms were coming into popularity.

III. **The Age of Chaucer** (1350-1400). John Wyclif made his translation of the Bible, which had wide influence; William Langland, or others whose names are not known, produced the remarkable *Vision of Piers Plowman*, that clarion call to justice and common honesty; but still England waited for its first really great writer. Not for long, however, for Chaucer was born about 1340, and despite his busy life produced poems that entitle him to the name "Father of English Poetry." Chaucer's work is treated fully elsewhere; here it is enough to say that with him all hesitancy vanished once for all from English literature, which had entered upon its period of steady development. The stage of preparation or transition was over; the troublesome dialects had crystallized, for literary purposes, into one language, and though it differed in spelling and in many inflections from Modern English, it may be read without great difficulty.

AN OUTLINE ON ENGLISH LITERATURE

An article on each author named appears in its alphabetical place in these volumes.

I. EARLY LITERATURE

Poetry

Beowulf
Caedmon's *Paraphrase*
Vision of Piers Plowman
Geoffrey Chaucer
The Canterbury Tales.

Prose

The Venerable Bede
King Alfred
John Wyclif

II. ELIZABETHAN AGE

Poets and Their Chief Works

Non-Dramatic
Edmund Spenser. 1552-1599
Faerie Queene
Dramatic
William Shakespeare. 1564-1616
Hamlet
As You Like It
Ben Jonson. 1573-1637
Every Man in His Humor
Christopher Marlowe. 1564-1593
Tamburlaine

Prose Writers and Their Chief Works

Sir Walter Raleigh. 1552-1618
History of the World
Francis Bacon. 1561-1625
Essays

III. THE PURITAN AGE

Poets

John Milton. 1608-1674
Paradise Lost

Prose Writers

Izaak Walton. 1593-1683
The Compleat Angler
Jeremy Taylor. 1613-1667
Holy Living and Holy Dying
John Milton
Areopagitica

IV. THE AGE OF RESTORATION

Poets

John Dryden. 1631-1700
Alexander's Feast

Prose Writers

John Bunyan. 1628-1688
Pilgrim's Progress
John Locke. 1632-1704
Essay Concerning Human Understanding
Sir Isaac Newton. 1642-1727
Optics

V. AUGUSTAN AGE

Poets

Alexander Pope. 1688-1744
Essay on Man
Edward Young. 1683-1765
Night Thoughts

Prose Writers

Joseph Addison. 1672-1719
Sir Roger de Coverley Papers
Essays
Richard Steele. 1672-1729
Essays
Jonathan Swift. 1667-1745
Gulliver's Travels
Daniel Defoe. 1661-1731
Robinson Crusoe

VI. THE AGE OF JOHNSON

Poets

Thomas Gray. 1716-1771
Elegy Written in a Country Churchyard
Oliver Goldsmith. 1728-1774
The Traveller
She Stoops to Conquer
William Cowper. 1731-1800
The Task
Robert Burns. 1759-1796
Cotter's Saturday Night

Prose Writers

Samuel Richardson. 1689-1761
Clarissa Harlowe
Henry Fielding. 1707-1754
Tom Jones
Samuel Johnson. 1709-1784
Rasselas
David Hume. 1711-1776
History of England
Edward Gibbon. 1737-1794
Decline and Fall of the Roman Empire
Edmund Burke. 1729-1797
On Conciliation with America

VII. THE ROMANTIC AGE

Poets

Walter Scott. 1771-1832
The Lady of the Lake
George Gordon Byron. 1788-1824
Childe Harold's Pilgrimage
John Keats. 1795-1821
Endymion
Eve of St. Agnes

An Outline on English Literature—Continued

William Wordsworth. 1770-1850
Ode on Immortality
Lines on Tintern Abbey
Samuel Taylor Coleridge. 1772-1834
The Ancient Mariner
Kubla Khan
Robert Southey. 1774-1843
Joan of Arc
Percy Bysshe Shelley. 1792-1822
Ode to the West Wind
Ode to a Skylark

Prose Writers

Walter Scott
Ivanhoe
Kenilworth
Charles Lamb. 1775-1834
Essays of Elia

VIII. VICTORIAN AGE

Poets

Alfred Tennyson. 1809-1892
In Memoriam
Idylls of the King
Elizabeth Barrett Browning. 1806-1861
Sonnets from the Portuguese
Robert Browning. 1812-1889
Andrea del Sarto
The Ring and the Book
Thomas Babington Macaulay. 1800-1859
Lays of Ancient Rome
Dante Gabriel Rossetti. 1828-1882
The Blessed Damozel
Algernon Charles Swinburne. 1837-1909
Atalanta in Calydon

Historians

Thomas De Quincey. 1785-1859
History of England
Henry Hallam. 1777-1859
Constitutional History of England
James Anthony Froude. 1818-1894
History of England

Essayists

Thomas De Quincey. 1785-1859
Confessions of An Opium Eater
Thomas Carlyle. 1795-1881
French Revolution
John Ruskin. 1819-1900
Sesame and Lilies

Theologians

John H. Newman. 1801-1890
Lead, Kindly Light
C. H. Spurgeon. 1834-1892
The Saint and His Saviour

Scientists

Sir Charles Lyell. 1797-1875
Elements of Geology
Charles Darwin. 1809-1882
Origin of Species
Descent of Man
Thomas Huxley. 1825-1895
Man's Place in Nature
Herbert Spencer. 1820-1903
First Principles

Novelists

Charles Dickens. 1812-1870
Pickwick Papers
David Copperfield
William Makepeace Thackeray. 1811-1863
Henry Esmond
Vanity Fair
George Eliot. 1819-1880
Silas Marner
Adam Bede

IX. MODERN PERIOD

Poets

Matthew Arnold. 1822-1888
Sohrab and Rustum
Dover Beach
Robert Bridges. 1844-
Prometheus the Firegiver
John M. Synge. 1871-1909
Deirdre of the Sorrows
William Butler Yeats. 1865-
The Wind Among the Reeds
John Masefield. 1875-
The Tragedy of Nan
The Everlasting Mercy

Prose Writers

Charles Kingsley. 1819-1875
Westward Ho
Robert Louis Stevenson. 1850-1894
Dr. Jekyll and Mr. Hyde
Rudyard Kipling. 1865-
The Jungle Book
Kim
Maurice Henry Hewlett. 1861-
The Queen's Quair
Arthur Conan Doyle. 1859-
Micah Clarke
Adventures of Sherlock Holmes
Arnold Bennett. 1867-
The Old Wives' Tale
Clayhanger
James M. Barrie. 1860-
The Little Minister
Sentimental Tommy
George Bernard Shaw. 1856-
Man and Superman
Candida
John Galsworthy. 1867-
Fraternity
Justice

IV. Elizabethan Age (1550-1620). Leading up to this period, which sets the high-water mark for the world's poetry, was a period (1400-1550) which produced few really great works, probably because it was one of the most troubled, changing times in all England's history. Malory wrote his *Morte d'Arthur;* More, his *Utopia;* Tyndale translated the New Testament, and unknown poets of Scotland made cycles of ballads, but there are no names which stand out as does that of Shakespeare in the age of Elizabeth. Several steps in advance were taken, however. The Earl of Surrey introduced into one of his translations "a strange meter"—blank verse—which was then used for the first time in England. The development of which it was capable is evident from the fact that Shakespeare and Milton used it for their masterpieces. Also, printing was introduced. That statement deserves all the emphasis which can be placed upon it, for it is difficult now to understand the immense influence which it had on learning and on the production of books.

Under Elizabeth, England took its place as the foremost literary nation in the world. The wonderful discoveries and explorations in America fired men's imaginations; the victory of the English fleet over the Armada roused them to frenzies of patriotism; scientific discoveries changed social conditions, and greater religious security helped to make life freer and richer. Literature felt the impetus of all these forces. Thoughtful essays, brimming with the new sciences of the day; poetry so splendid in its music and its imagery that all later ages have gone to it for inspiration; marvelous dramas never since equaled, were poured out in a flood in those fifty years. The name of Shakespeare so far outshines all others that often the lesser lights are almost lost sight of, but Francis Bacon, Edmund Spenser, or Ben Jonson alone would have been enough to shed luster on any age. Besides these there were Sir Walter Raleigh, Christopher Marlowe, Sir Philip Sidney and others, all noteworthy writers. With its intense love of life and of action, this age expressed itself primarily, but by no means exclusively, in the drama.

V. The Puritan Age (1620-1660). Old ideals of government and religion were breaking up, and new ones had not been found to take their place, so this age was restless, unsatisfied, and as a result, gloomy. The thirst for beauty, the romantic ardor which breathed through almost everything written during the Elizabethan Age, are no longer to be found in literature, for the love of beauty is sacrificed to the search for truth. There were numerous minor poets, but they emphasized form rather than feeling, and were artificial and intellectual rather than truly poetic. But there was one poet who would have graced any age or nation—John Milton, with his "voice whose sound was like the sea." In prose, too, Milton was the foremost figure of this period, but he was not able to keep himself free from the argumentative tendency of the times, and his prose work therefore lacks a lasting appeal. Robert Burton's curious *Anatomy of Melancholy,* Browne's *Religio Medici* and Izaak Walton's *Compleat Angler,* all books that will live, date from this period. Thoroughly Puritan in spirit, the voice of the age in prose as Milton was in poetry, was John Bunyan, whose *Pilgrim's Progress* was not published until long after the close of the Puritan Age.

VI. Period of the Restoration (1660-1700). Sharp indeed was the break between the Puritan Age, with its gloom, and the Restoration period, with its impatience of all restraint. Gayety was the keynote—gayety carried to the point of frivolity; and Shakespeare's greatest dramas were looked upon as insipid and unrefined. Imitations of French writers were numerous, and as the faults rather than the excellencies of the originals were brought over into English, literature in England was in a bad way. There was cleverness, but it was joined with such low moral ideals that most of the poems and plays of the day are unreadable now. Even Dryden, a true poet, was influenced by the demands of the times and produced a number of plays which reflected the looseness of Restoration court society. The *Hudibras* of Samuel Butler, published in 1663, showed how complete was the reaction against Puritanism.

There was one wholesome tendency—that toward simplicity of form. The earlier ages had indulged in verbal extravagances, and if for a time the Restoration poets overdid the pruning process and were stiff and formal, the trouble righted itself later on and an increased naturalness of manner was the result.

VII. Eighteenth-Century Period (1700-1800). This was primarily an age of prose, for the myriad interests which were seeking expression were not romantic and poetic, but practical, and in a sense prosaic. The imaginative, the romantic, was not popular, and satire had full sway. Pope, it is true, wrote poetry which in

his own day was accounted better than that of Shakespeare, but it was cold, formal and artificial, entirely lacking in high poetic inspiration. That the Augustan Age, as the first part of the century is called, was a brilliant one may be seen from the names of its writers. During that period Swift produced his *Gulliver's Travels* and his other matchless satires; Addison and Steele wrote their famous *Spectator* papers; and Defoe won thousands of readers with that earliest of novels, *Robinson Crusoe*. The popular *Spectator* was a pioneer in a movement of great importance which finally resulted in the modern newspaper, while the mention of *Robinson Crusoe* indicates another development—that of the novel (which see).

An outstanding figure during the middle of the century was Samuel Johnson, about whom gathered a group of distinguished men—Burke, Goldsmith, Boswell and others—who bowed to his literary dictatorship.

Side by side with the "classic" tendencies of the authors mentioned above, there was growing up a new spirit of romanticism. Thomson, Gray, Cowper, Blake, and, foremost of all, Burns, revolted against the "common sense" standards and demanded that imagination be allowed its rightful place in poetry. A renewed appreciation of nature was evident, and a far greater affection and sympathy for human beings.

VIII. **The Romantic Age** (1800-1850). This was a carrying out of the principles more or less consciously formulated by these early romanticists (see ROMANTICISM). Poetry rather than prose was the dominant literary form, and Wordsworth, Coleridge, Byron, Shelley and Keats reflected in their matchless verse the demand of the age for freedom from affectation. Alike in that one particular, they differed widely in others, for romanticism allowed the expression of individual genius, unbound by general rules. Poets of lower rank, who would have ornamented an age less splendid in genius, were Scott, Moore and Southey, the first-named being remembered rather for his prose than for his verse, for Scott is the outstanding prose writer of the age, and his novels show the romantic spirit as clearly as does his poetry. Lamb, De Quincey and Jane Austen are perhaps the only other writers of prose whose works still find a wide audience.

IX. **The Victorian Age** (1850-1900). Variety seems at first sight to be the keynote of this period, for almost every branch of literature is represented, and by works of high rank. The progress of science, the inventions that came with increasing frequency, the working out of the doctrine of evolution, the social unrest, all left their mark on the literature, and careful study shows that this was all actuated by a more or less definite moral purpose. The writers were the teachers of the people, not unpleasantly didactic, but speaking out with no uncertain voice and teaching charity and the brotherhood of man. The novels as well as the poetry and the essays show clearly this trait—who can fail to find it in those of Dickens, Thackeray or George Eliot? Primarily, this was an age of prose, the three great writers just mentioned, with Macaulay, Arnold, Carlyle and Ruskin, making up a group unmatched in any other age. But poetry was not neglected, and at least two of the Victorian poets are entitled to first rank—Tennyson and Browning; while of the lesser poets, Rossetti, Elizabeth Barrett Browning and Swinburne produced work of which no age need be ashamed. All in all, it is probable that future generations, looking back to the Victorian Age, will call it one of the greatest in the history of English literature.

X. **More Recent Literature.** To give any general characteristics of the literature of to-day is difficult and unsafe—only with perspective is sound judgment possible. It is a period of restless activity in every field, and poems, dramas, plays, essays, history, criticism and biography pour from the presses in a never-ending stream. Of the prose writers, Kipling, Hewlett, Bennett, Galsworthy, Barrie and Shaw will perhaps best repay study, while among the poets Yeats and Masefield have attracted most favorable attention.

The literature of England is not the only literature written in the English language. Across the sea there have grown two literatures of goodly proportions, one in Canada and the other in the United States. These are treated under the titles AMERICAN LITERATURE and CANADIAN LITERATURE. A.MC C.

Consult Dawson's *Makers of Modern English;* Beers' *From Chaucer to Tennyson;* Mrs. Oliphant's *Literary History of England in the Eighteenth and Nineteenth Centuries.*

ENGRAVING, the art of cutting characters, figures or designs of any kind on a hard surface. The earliest engraving was undoubtedly done for ornamentation or decoration. The rock carvings of primitive cliff-dwellers, the inscriptions of the ancient Egyptians, Greeks

and Romans, were of this character. So, too, the Chinese and the Japanese worked elaborate designs on bronze and copper, and probably every reader of this article has seen silverware engraved in more or less elaborate designs. This latter engraving is done solely for the beauty of the design.

Engraving, however, may also be employed for the sake of reproductions which may be printed from it. If an engraved surface is covered with ink and then laid on a piece of paper, the paper will show an impression of the engraving. Such a reproduction is not itself an engraving, but is a *print*. If the ink is spread lightly over the surface of the engraving the lines which have been cut will appear white in the print; this is called *relief* engraving. On the other hand, if the ink is forced into the lines of the design and the surface of the plate is wiped clean, the design will appear in black or colored lines on a white ground; this is properly called *line* engraving, and is represented in these volumes by thousands of black and white illustrations. Relief engraving is usually done on wood; line engraving is usually on copper or steel. If the lines are eaten or bitten into a plate by means of an acid, the process is *etching*, and if the surface is merely roughened, without actually cutting lines, it is called *mezzotint*. Until the discovery of the various processes of photo-engraving, these were the chief means of reproducing designs of any kind; they are discussed briefly here in the order in which they became important.

Wood Engraving. The earliest engraving for the purpose of printing seems to have been by the Chinese, who, from the most ancient times, carved figures on wood blocks. It seems to have had an independent origin in Europe after the introduction of paper in the twelfth century, but the oldest existing print whose date is certain was printed in 1423. The great master of wood engraving is Albrecht Dürer, whose work has been unsurpassed even to the present time. Other great engravers on wood were Hans Holbein (1497-1543), Lucas Cranach (1472-1553), Thomas Bewick (1753-1828), and Timothy Cole (1852-).

Line Engraving. As the name indicates, the design or pattern is cut in lines, usually on plates of copper or steel. The instrument used for this purpose is the burin, or graver, a short steel bar, with a sharp, triangular point. The burin is held in the palm of the hand and pushed forward along the plate, in which it cuts a groove. Usually the lines are first drawn lightly on the steel or copper, and then cut by the graver. The artist first makes a narrow, shallow groove and afterwards cuts it again and again until it has the desired width and depth. The peculiar appearance of a line engraving, with the design slightly raised above the rest of the paper, is due to the method of printing. The surface of the plate is wiped clean, ink being left only in the grooves. The paper, usually dampened, is then pressed so tightly against the plate that the edges of the grooves show on the paper. In fine prints every line of the engraving will appear slightly raised.

The earliest line-engravers, men like Dürer, Schongauer and Lucas van Leyden, did original work, but in the seventeenth and eighteenth centuries line-engraving was used chiefly for the reproduction of paintings. A few names—Nanteuil, Edelinck, Eisen, Cochin—stand out as those of great artists, but most line-engravers, down to the present, have copied the work of others. For this reason line-engraving fell into disfavor among creative artists; the development of photo-engraving processes in the nineteenth century practically ended its career. The new mechanical processes are cheaper, quicker and for most purposes equally satisfactory. Only for printing bank notes and a high grade of portraits is line-engraving still in common use.

Etching. Etching, on the contrary, has always been regarded as one of the proper means of artistic expression. It has a less formal technique, is more quickly done and gives wider opportunities for individuality. Rembrandt, the father of etching, and probably the greatest etcher who has ever lived, was also one of the world's greatest painters. The etching process is similar to that of line-engraving, except that the lines are bitten out by an acid.

Mezzotint. This is a special form of engraving on copper or steel. The plate is first reduced to a mass of small, prickly points by means of a rocker. The rocker cuts the metal into ridges, and as it is rocked and turned leaves hundreds of tiny projecting points. These points must be smoothed down or cut away entirely to produce a design. For further details see MEZZOTINT. W.F.S.

Related Subjects. The reader is referred to the following articles in these volumes:

Dürer, Albrecht	Photo-Engraving
Etching	Rembrandt
Mezzotint	Wood Engraving

ENID, *e'nid,* OKLA., the county seat of Garfield County, and a market and trade center for the productive agricultural country in the north-central part of the state. It is fifty-five miles northwest of Guthrie, ninety miles northwest of Oklahoma City, the state capital, and ninety-seven miles south of Wichita, Kan. The city is on the Chicago, Rock Island & Pacific, the Saint Louis & San Francisco and the Atchison, Topeka & Santa Fe railroads. The population in 1910 was 13,799; in 1916 it was 20,307.

Enid is in a rich wheat country, and usually is the market for a crop of 5,000,000 bushels from Garfield County. Next in importance to wheat-raising is the poultry business. The value of poultry and eggs handled each year by five wholesale houses in Enid exceeds $3,000,000. The alfalfa fields of the county yield four or five cuttings a year, providing forage for great numbers of horses, mules, hogs and cattle. Creameries and machine shops, boiler works, tile works and manufactories of corn seeders and binders and steel posts are the important industrial enterprises. Natural gas was discovered in the vicinity in 1907.

The prominent buildings are a Federal building costing $125,000, completed in 1912; the courthouse, erected at a cost of $100,000; a Carnegie Library, an opera house and a $200,000 high school building. Enid contains the Phillips Christian University, Saint Francis Institute (Roman Catholic), a college of fine arts and a business college, and it is the seat of the state institute for the feeble-minded.

Enid was founded and chartered as a city in 1893. The commission form of government was adopted in 1909. Water for both drinking and irrigating is obtained between forty and fifty feet under ground. W.H.S.

ENSIGN, *en'sine,* a name applied to a national flag. It is also the title of officers of the lowest commissioned rank in the United States navy, after graduation from the Naval Academy. Until 1862, when the title was adopted, midshipmen were graduated into the navy as *passed midshipmen.* In the United States navy the pay of an ensign is $1,700 yearly, with an increase of ten per cent after five years' service; the corresponding rank in the army is that of second lieutenant. In the British and United States armies ensigns were formerly entrusted with the colors, or ensigns, of the regiment. So devoted were they to the traditions embodied in the flag that death was preferable to loss of the ensign they guarded. Ensign was the title of the lowest rank of commissioned officers in the British army until 1871, when it was succeeded by that of second lieutenant.

ENSILAGE, *en'si laje,* the name given to the green crops stored in a silo. See SILO AND SILAGE.

ENTOMOLOGY, *en toh mol'o ji,* the branch of zoölogy that treats of insects. The various species of insects greatly exceed in number all other animals taken together, so it is natural that their study requires a special division of zoölogy, under a distinctive name. The science of insects began with Aristotle, who included in a class the true insects, the arachnids and the myriapods. These are distinguished from other classes of insects by the fact that the three divisions of the body—the head, thorax and abdomen—are always distinct from one another. With the publication of Darwin's *Origin of Species* a fresh interest developed in entomology, and in fact in all branches of zoölogy, as it was discovered that insects form a convenient group for the exposition of certain problems of animal evolution. See ARACHNIDA; MYRIAPODA. L.O.H.

ENVELOPE, *en've lope,* a covering, usually of paper, with gummed edges for sealing, in which a communication may be safely sent through the mail. Many improvements have been made in the machinery employed for making envelopes, until the output of some machines, which are of American invention, is 55,000 a day. With the increased number made, the cost of production has lessened until envelopes may now be purchased, in large quantities, with return address printed, at a cost of about fifty or sixty cents per thousand. Previous to the invention of these machines, which now make envelopes in a continuous operation, only about 3,000 could be made in a day, as they were cut out by chisels and folded and pasted by hand.

Until 1840, before the invention of envelopes, all letters were folded so that a blank portion of the paper was left for the address, and they were then sealed by means of sealing wax. Envelopes are in various sizes, but in proportionate widths and lengths in all standard sizes. For identification the sizes are numbered from 5 to 10. A number 5 envelope is five inches long and three inches wide; a number 6 is six inches long and three and one-eighth inches wide. The usual commercial envelope is called number 6¾; it is nearly seven inches in length.

ENVIRONMENT, *en vi'run ment*, from the French word meaning *to surround*, covers the broadest possible field, for it involves all the outside conditions under whose influence every vital thing lives and moves and has its being. Thus it includes not only the *physical environment* implied by climate, contour (topography), food supply, the laws governing light, darkness, sound and the like, but also the *social environment* implied by race, customs, religion, and the institutions of family and state. Of the two, physical environment has the stronger influence and, indeed, practically determines the social. Plants, animals, men and women—all are affected, and to a great extent molded, by their physical environment. The industries of a community or a country, the physical, mental and moral traits of an individual or a people, even the political destiny of a nation, if traced back far enough, will be found to root in physical environment.

The Element of Climate. Climate is perhaps the most important element in physical environment. Heat and moisture, which constitute climate, largely govern the distribution of life on the earth. Hot countries, for instance, produce a more luxuriant vegetation and are more densely populated by the human family, because here the problems of food, shelter and clothing practically solve themselves. This very ease of living, however, leads to habits of slothfulness and indifference and to the loss of alert mental faculties, because man has little need to exercise them. A representative product of such an environment is the native African or Malaysian.

Extremely cold countries, on the other hand, are thinly populated; people live in small, scattered groups, without political organization; and so much energy is consumed in wresting a mere living from nature, so deadening is the monotony of diet and season, that man has neither leisure nor inclination to develop his higher powers. Such an environment produces the Eskimo—stolid, unambitious, unintellectual. See ESKIMO.

Arid regions develop an alert, self-reliant type, like the Sahara Arab or the old-time American Indian of the Great Plains, forced into nomadic or semi-nomadic habits through the need of going in search of food and water for the herds and flocks which represent the instruments of the only "trade" possible in that particular environment. See NOMAD LIFE.

The ideal environment is that of the *temperate zones*, where conditions of living strike a balance, where there remains a fair amount of leisure for self-development, and where varying seasons and sudden changes in temperature keep both mind and body wholesomely stimulated. It is worthy of note that with few exceptions, the great cities of the world are not far from the 40th degree of north latitude.

Characteristics of the plant and animal life of a region depend, no less than the human, upon the climate environment. The degree of moisture is so important a factor in plant environment that the vegetation on the dry and that on the rainy side of the same mountains are often as different as though belonging to two widely-separated areas. Rainfall is such an essential factor of man's environment that an insufficient rain supply has been the cause of many great migrations, especially in the early stages of history.

Adaptation to Environment. Every living thing must be in harmony with its environment or it cannot continue to exist; and as the forces which move the world are constantly creating new environments, life is continually adjusting itself to changing conditions. This readjustment is what constitutes progress and evolution. *Adaptation* is the name given to the process of becoming fitted to environment; and the phrase, "the survival of the fittest," implies that only those forms of life have survived through the ages which were most perfectly adapted to their environment. In fossils we read the ever-fascinating story of the relation that has existed from earliest times between environment and life. See EVOLUTION; FOSSIL.

Adaptation, however, is also a matter of present-day history. A plant species will in time adjust itself to a very dry and sandy soil by growing long roots which reach out after moisture. Some plants of the desert have roots fully five times the length of their stalks. The wild rose, to be certain of spreading its species, grows a great number of stamens; the cultivated rose, no longer needing this protective measure, adjusts itself to its new environment and puts into extra petals the life-force that formerly went to make extra stamens. In the development of the dog from the wolf; the horse from the primitive eohippus; the big, juicy apple of cultivated orchards from the tiny wild fruit of the Black Sea, and in countless other similar instances we get chapter after chapter of the story of plant or animal life adapting itself to changing physical environment.

Man and Adaptation. Of all the animals, man has been the most successful in adjusting himself to different physical environments. He can bear the greatest extremes of climate. His ingenuity enables him to live in tropical climates or in the icy polar regions, in desert lands or in parts of the earth where it rains for the greater part of the year. He responds to his environment in his way of living, of clothing himself, of enjoying himself, of sustaining himself through labor. When he runs counter to his environment he usually meets with disaster.

Modification of Environment. Man has discovered that, although environment cannot be made over, he can modify it within limits so as to make life easier, richer, better worth living. The measure of civilization is somewhat a matter of the degree to which man ceases to be entirely the creature of his environment. It is to conquer his environment or adapt it to his needs and desires that he tunnels through mountains, bridges rivers, changes the course of streams, digs irrigation canals and builds railroads, ships, flying machines and great telephone and telegraph systems in order to provide easier intercourse with his fellows. He modifies his climatic environment by the special character of his architecture and by devices for heating or cooling his home. He is even learning, through the work of such men as Luther Burbank, that he can do for plants what he cannot do for himself—*create* new environments to develop new species, effecting in a few years changes that nature takes cycles to accomplish. Cultivation is only another way of expressing changed environment.

Social Environment. As civilization advances, greater emphasis comes to be placed on social environment, particularly in its application to the early education of the child. Burbank has said:

> "I have taken the common daisy and trained it and cultivated it by proper selection and environment until it has been increased in size, beauty and productiveness at least four hundredfold. * * * Surround the child with the proper environment to bring out certain qualities and the results must come."

However, the consideration of social environment is more properly the province of sociology, and reference should be made to the articles on that subject and to the discussion under HEREDITY. L.M.B.

EOCENE, *e'o seen,* **PERIOD,** a division of geologic time, immediately following the Cretaceous Period and forming the oldest division of the Cenozoic Era. The name means the *Period of the New Dawn.* In North America the rocks formed during this period extended along the Atlantic coast and the Gulf of Mexico and up the Mississippi Valley north of the Ohio. They are also found in some places in the Rocky Mountains. The rocks are sandstone, limestone, marls and clays. By the end of this period nearly all existing groups of mammals had become clearly defined. See CENOZOIC ERA; CRETACEOUS SYSTEM; GEOLOGY.

EPAMINONDAS, *e pam i non'das,* a general and statesman of Thebes, a master of tactics and of strategy. His influence on military art in Greece was powerful. Realizing the increasing maritime power of Athens, he equipped a fleet of 100 triremes (see GALLEY) and won several cities from the Athenian confederacy. When complications threatened Thebes he mustered a large army and four times successfully invaded the Peloponnesus, or southern peninsula of Greece, at the head of the Thebans. His great achievement in politics was the final overthrow of Sparta's power in the Peloponnesus by a decisive battle on the site of Mantineia. Epaminondas was severely wounded during that combat.

EPHESUS, *ef'e sus,* "the city of the Ephesians," one of the twelve ancient cities of Asia Minor. The location here of the Temple of Diana made Ephesus a sacred place from an early date; one of the most common expressions which have come down the ages is "Great is Diana of the Ephesians." Its situation at the starting point of one of the great trade routes of Asia Minor led to its commercial growth. Saint Paul's labors in Ephesus, lasting three years, indicate its prosperity (*Acts* XVIII-XIX; *I Cor.* XV-XVI). A powerful Christian church was established in the city, and prominent men of the Apostolic age made their headquarters there. The destruction of its great temple by the Goths in A.D. 263 marked the beginning of the decline of Ephesus, and before the days of Tamerlane (see TIMUR) it had almost perished.

EPIC, *ep'ik,* a narrative poem of a very special type. *Paul Revere's Ride, An Incident of the French Camp* and Tennyson's *Revenge* are narrative poems, but they cannot be classed as epics, for, according to a high authority—

> The subject of an epic poem must be some one great, complex action. The principal personages must belong to the high places of the world, and must be grand and elevated in their ideas and in their bearing. The measure must be sonorous.

This does not mean that every-day matters cannot be introduced, but that they must be subordinate to the central lofty theme. With conditions so hard to meet, it must be an ambitious poet who attempts an epic. Not all who have made the attempt have been successful, but almost every great language of the world has one outstanding epic; only the Greek has more than one. In Greek there are the *Iliad* and the *Odyssey;* in Latin there is the *Aeneid;* in Italian, Dante's *Divine Comedy;* in German, the *Nibelungenlied;* in Spanish, the *Poem of the Cid;* in French, the *Chanson de Roland;* in English, *Paradise Lost,* and in Finnish, the *Kalevala.*

These epics group themselves naturally into two classes—the national, or folk, epic, and the literary epic. The process whereby an epic of the former class came into existence is most interesting. No poet ever declared, "I shall write a great poem about the national hero;" no one man composed all the ringing verses; but gradually, year by year and perhaps century by century, songs grew up about some favorite hero until there was a great cycle. One singer added new narrative, another polished rough places in the old, and so, with unnumbered authors, the national epic reached its completion. Critics believe that the *Iliad* was so written, and perhaps the *Odyssey;* certainly the *Cid* and *Roland* poems and the *Nibelungenlied* were so composed. But the *Aeneid,* the *Divine Comedy* and *Paradise Lost* are different, for each is the work of one man, and is consciously modeled on the other type of epic.

If the term *epic* be used less rigidly, as it sometimes is, many other poems may be included under it. Thus *Hiawatha* may stand as the American epic, while Pope's *Rape of the Lock* takes rank as a mock epic. C.W.K.

Related Subjects. The reader will find reference to the following articles in these volumes interesting and profitable.

Aeneid	Nibelungenlied
Iliad	Odyssey
Literature	Paradise Lost

EPICTETUS, *ep ik te'tus,* from the Greek, meaning *The Acquired,* was a Stoic philosopher, born at Hierapolis, in Phrygia, Greece. In his youth he was the slave of Nero's freedman Epaphroditus. He afterwards lived and taught at Rome until banished by the Emperor Domitian in A.D. 90. His teachings, which are known only through the notes preserved by his pupil Arrian, more nearly approach the spirit of Christianity than any other ancient philosophy. They include the love of good and hatred of evil, obedience to the dictates of conscience and a perfect trust in a wise and merciful Providence. See Stoicism.

EPICURUS, *ep i ku'rus* (342-270 B.C.), illustrious Greek philosopher and founder of the Epicurean school, was born on the island of Samos. He settled in Athens, and in 307 B.C. established a school of philosophy in a garden which he purchased and laid out for this purpose. Because of this incident, his followers were known as the "philosophers of the garden." He is said to have written extensively, although only three of his letters, a few fragments, and a number of sayings have come down to us. The principal sources of our knowledge of Epicurus are Cicero, Plutarch and Lucretius. He was a successful teacher, and his pupils, who came in great numbers from all parts of Greece, Rome and Asia Minor, were devoted to their master as well as to his doctrines.

Epicureanism, a system of philosophy in vogue the latter part of the fourth century B.C. Although Epicurus, the founder, laid down the doctrine that pleasure is the chief good, the life that he and his friends led was one of greatest temperance and simplicity. In psychology, Epicurus was a materialist, holding that the soul is a bodily substance composed of intangible particles scattered through the whole body. "Business, and cares, and anger, and benevolence," he argues, "are not accordant with happiness, but arise from weakness, and fear, and dependence upon others."

According to Epicurus, the sources and tests of all moral truth are the feelings—pleasure and pain. We delight in one and avoid the other. "When we say that pleasure is the end of life, we do not mean the pleasure of the debauchee, but freedom of the body from pain and the soul from anxiety." The philosopher rested justice on the same basis as temperance. Denying any abstract and eternal right and wrong, he believed injustice to be an evil, because it exposed the individual to discomfort from his fellowmen. The duties of friendship and good fellowship he based upon the same theories of security to the individual.

Believing that the dissolution of the body involves that of the soul, Epicurus argued that the most terrible of all evils, death, is nothing to us, "since when we are, death is not; and when death is, we are not. It is nothing then to the dead or the living; for to the latter it

is not near, and the former are no longer in existence." According to the Epicurean belief, the great evil that afflicts men is fear—fear of gods and fear of death. To get rid of these two fears was the ultimate aim of all Epicurus's theories and nature. R.D.M.

EPIDEMIC, *ep i dem' ik,* a term derived from two Greek words meaning *among the people,* and applied to diseases which attack many people at the same time or in rapid succession. Malaria, influenza, dysentery, cholera, the plague, diphtheria and typhoid are among the diseases which thus attack a community. Every epidemic has its own particular infectious germ. In the case of malaria the infection is due to an animal parasite, and the disease is spread by mosquitoes which have bitten and sucked the blood of someone already suffering from malaria. The bacteria of cholera, dysentery and the plague are carried by human beings or merchandise from country to country, and wherever these germs find people susceptible to those diseases an epidemic breaks out.

Medical science has in recent years done much to reduce the danger of epidemics. The Panama Canal Zone is a striking example of what may be done to improve the health of a community. There the malaria-bearing mosquito has been stamped out, its breeding places in swamps and pools have been drained, and a region once deadly to white men has been rendered practically free from disease. Smallpox, the most dreaded of all epidemics, has been rendered less harmful by preventive measures; vaccination has almost removed smallpox from the list of epidemics in America and most European countries. Medical science in earlier days devoted itself to fighting disease after it had developed; science now seeks causes and endeavors to remove them.

Perfect drainage and sanitation, paving and cleaning of streets and filtration of drinking water are important preventives. Remarkable results have been recently obtained by inoculation. The science of serum therapy has made great progress, and nowhere has it been more clearly proved than in Serbia in 1914, when practically the whole army was attacked by typhoid. The epidemic was completely stamped out by surgeons under the command of Surgeon-General Gorgas of the United States army, who was loaned for the task. Many thousands were inoculated, and early in 1915 the Serbian army took the field with its men in good health and practically safe from future attacks of typhoid fever. J.H.K.

Related Subjects. In addition to the diseases mentioned above, the reader is referred to the following articles in these volumes:

Bacteria and Bacteriology	Inoculation
Gorgas, William Crawford	Mosquito
	Sanitary Science
	Serum Therapy

EPIGRAM, *ep' i gram,* as most correctly used, is a short poem, generally not more than eight lines in length, which has at the very close a sudden surprising or witty turn. An old Latin author, whose name is unknown, in describing the epigram produced a very clever one:

The qualities rare in a bee that we meet,
In an epigram never should fail—
The body should always be little and sweet,
And a sting should be left in its tail.

Quite as often, however, the term means any concisely or cleverly expressed thought, whether in prose or verse; and while the "sting in its tail" is not necessary, it is desirable. Martial's reflection on his wife, though far from kindly, is typical:

Lycoris has buried all the female friends she had; would she were the friend of my wife!

The Greeks, who invented the epigram, made of it a thing very different from its modern descendant. With them it was a simple and beautiful verse on a tomb or statue, and the word has the same literal meaning as *epitaph.* It was the great Roman satirists, Catullus and Martial, and especially the latter, who made the epigram the sharp, stinging thing it is to-day, and Martial's epigrams have remained the model for all times. Among the English, Pope was the cleverest of all epigram writers, and some of his poems are but strings of epigrams. The following are from his pen:

Why has not man a microscopic eye?
For this plain reason—man is not a fly.

Vice is a monster of so frightful mien
As to be hated needs but to be seen;
Yet seen too oft, familiar with her face,
We first endure, then pity, then embrace.

But thousands die without or this or that—
Die, and endow a college or a cat.

Who builds a church to God and not to fame,
Will never mark the marble with his name.

And the parodist who mocked at Pope told of his defects very concisely in an epigram:

One line for sense and one to make the rhyme
Make a good Popish couplet every time.

A quick and clever exchange of epigrams took place between Charles II and one of his courtiers, whose identity is uncertain.

Here lies our sovereign lord, the king,
Whose word no man relies on,
Who never said a foolish thing,
And never did a wise one,

wrote the courtier, to which Charles replied, "True, for my words are my own; my actions are my ministers'."

If the word be considered in its wider meaning, any of the proverbs are epigrams. The following are excellent examples:

All that glisters is not gold.—*Shakespeare.*
Hope deferred maketh the heart sick.—*Bible.*
A soft answer turneth away wrath.—*Bible.*

EPILEPSY, *ep'i lep si,* or **FALLING SICKNESS,** is a nervous disease which manifests itself in several forms. The epileptic who suffers from the most common type, called *grand mal,* falls insensible, uttering a wild scream, and immediately afterward undergoes convulsions of the whole body. Attending symptoms are foaming at the mouth and spasmodic movements of the lips, nostrils and eyes. The duration of such an attack varies from five to twenty minutes. As the convulsions gradually diminish in severity the patient passes into a condition of deep stupor, during which the breathing sometimes becomes very noisy. This state is followed by natural slumber, of varying duration. While such an attack may seem very alarming to the onlooker, it is not necessarily dangerous unless the patient injures himself in falling or bites his tongue during the convulsions. It is not wise to attempt restoration by means of powerful stimulants. The clothing may be loosened around the chest, and the head be raised a little, and the patient should have plenty of air. Sometimes an epileptic is warned of an approaching fit by noise in the ears, a feeling of nausea or faintness, loss of breath, or other sensation, but in many cases the attack comes on with no warning whatsoever.

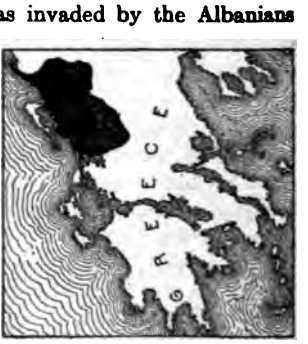
In *petit mal,* a less common form of epilepsy, the patient does not fall, but is unconscious for two or three seconds, and when he comes to himself he may not know that he has had an attack. Persons who suffer from *grand mal* sometimes have mild seizures that are of brief duration and are characterized only by slight twitchings of the body. Another form of epilepsy is the *psychic type,* some of the manifestations of which resemble those of insanity. Crimes are often committed by victims of psychic epilepsy. In some instances tumor of the brain, meningitis and similar disturbances cause spasmodic movements of a limited area.

There are many epileptics who have lived long and useful lives, and in history the names of a few victims of the disease shine brilliantly —Julius Caesar, Petrarch, Mohammed, Peter the Great and Napoleon. Impairment of the mental powers, however, is usually the outcome of *petit mal.* Frequency of attacks is a more serious feature of *grand mal* than severity. Recovery from epilepsy is rare, and the exact cause of the malady has long baffled physicians. It is supposed to be due to disease of the gray matter of the brain. Attention to hygiene and dieting is preferable to the use of curative drugs. Any drug powerful enough to control the spasms is sure to be demoralizing in its general effect. The disease is hereditary, and epileptics should not be allowed to marry. Several states have provided for colonies of epileptics, where rational treatment is resulting in lasting benefit to patients. W.A.E.

EPIPHANY, *e pif'a ni,* a festival observed on January 6 by the Roman Catholic, Anglican and Eastern churches in honor of the manifestation or presentation of Christ. Originally it commemorated the birth and baptism of Christ, but since the year 813 it has been celebrated as a special festival in honor of the manifestation of the Infant Jesus to the three *magi,* or wise men from the East, who were guided by the star to Bethlehem.

EPIPHYTES, *ep'i fytz.* See AIR PLANTS; PARASITES.

EPIRUS, *e pi'rus,* meaning *mainland,* was in ancient geography the extreme northwestern division of Greece. The kingdom of Epirus reached the zenith of its glory under Pyrrhus, in 295 B.C. It was invaded by the Albanians in the fourteenth century, was conquered by the Turks in the fifteenth century, and now forms part of the territory ceded to Greece in 1881 and 1913. The modern province of Epirus is bounded on the south by the Gulf of Arta and on the west by the Ionian Sea. Its capital, Janina, has a population of about 25,000.



EPIRUS

EPISCOPAL, *e pis'ko pal,* **CHURCH,** a religious sect in America, known as the Protestant Episcopal Church, which separated from the

Church of England in 1789 and prepared a constitution of its own. The prayer book adopted was nearly like that of the English Church, and in belief and organization the sect remained much the same. Although great effort was exerted to unite under this new organization the various bodies who owed original allegiance to the Church of England, the Church made very little progress until after 1811. Then the membership increased rapidly, and churches were established in thirteen states during the next ten years. The total membership in 1917 was nearly 1,000,000. The Church is governed by a general conference, which meets every three years and is composed of the bishops and four clergymen and four laymen from each diocese. Chief among the agencies within the Church which aid its work are eighteen sisterhoods, several orders of Deaconesses, and the Brotherhood of Saint Andrew, which enlists the active work of laymen and which has been very successful.

EPITAPH, *ep'i taf.* For ages past man has been accustomed to inscribe memorial words on the tombstones or other monuments placed above the graves of the dead. Such inscriptions are known as *epitaphs,* a term from two Greek words meaning *upon* and *tomb.* The term is also applied to literary memorials composed in honor of the dead, but not intended to be inscribed on a burial monument. The earliest-known epitaphs are those found on ancient Egyptian coffins, but these are simply statements of the name and family of the deceased, accompanied by a prayer to one of the gods, and there is no attempt to praise the character of the dead or to express the feelings of the survivors. The Greeks excelled in the composing of memorial inscriptions, those written by Simonides in honor of the heroes who perished at the Pass of Thermopylae being especially famous. Of these the most celebrated is the following:

Go tell the Spartans, thou that passeth by,
That here, obedient to their laws, we lie.

A well-known Latin epitaph is that in honor of Alexander the Great—"Here a mound suffices for one for whom the world was not large enough." Shakespeare himself is said to have written the quaint lines that are engraved on his tomb at Stratford, though poetically they seem unworthy of him:

Good frend, for Jesus' sake forbeare
To digg the dust enclosed heare;
Bleste be the man that spares thes stones,
And curst be he that moves my bones.

Of equal interest is the epitaph written by Benjamin Franklin for himself:

The body of
Benjamin Franklin, Printer,
Like the cover of an old book,
Its contents worn out,
And stript of its lettering and gilding
Lies here food for the worms,
Yet the work itself shall not be lost,
For it shall, as he believes,
appear once more,
In a new
and more beautiful edition
Corrected and amended
By the Author.

Robert Louis Stevenson lies under a mountain tomb in Samoa, upon which are inscribed the following noble lines from his own pen:

Under the wide and starry sky,
Dig the grave and let me lie.
Glad did I live and gladly die,
And I laid me down with a will.

This be the verse you grave for me:
"Here he lies where he longed to be;
Home is the sailor, home from the sea,
And the hunter home from the hill."

On the tombstones in the old English churchyards one may read many curious epitaphs. Over the grave of a useful member of the town of Weston appear these lines:

Here lies entomb'd within this vault so dark,
A tailor, cloth-drawer, soldier, and parish clerk;
Death snatched him hence, and also from him took
His needle, thimble, sword, and prayer-book.
He could not work, nor fight—what then?
He left the world, and faintly cried, "Amen!"

Near the west end of Holy Trinity Church, Stalham, Norfolk, there is a gravestone bearing this inscription:

John Amies, 1831.
Here lies an honest independent man,
Boast more ye great ones if ye can;
I have been kicked by a bull and ram,
Now let me lay contented as I am.

The epitaphs on the headstones in New England burial grounds are often quaintly philosophical. One departed sister, who sleeps in the graveyard of Rowley, Mass., thus admonishes the living:

Here in the silent grave I lie
No more the scenes of life to try,
And you, dear friends, I leave behind,
Must soon this gloomy mansion find.

In the famous old Boston cemetery called Copp's Hill Burial Ground is the following eulogy in verse, representative of many others:

This humble stone proclaims the truth—
Here lies a much respected youth
But now cut down in early prime,
And far beyond the ills of time
In brighter worlds and clearer skies
Shall all his manly virtues rise.

To the many people interested in collecting unusual records of the above nature the following books are recommended: Kippax's *Churchyard Literature: A Choice Collection of American Epitaphs;* Andrews' *Curious Epitaphs.*

E PLUR'IBUS U'NUM, the motto of the United States, is a Latin phrase which means *Out of Many, One.* It appeared first on the design for the Great Seal recommended to the Continental Congress by a committee composed of Franklin, Adams and Jefferson, on July 4, 1776. The motto is displayed on several coins, though it has never been officially approved for this purpose.

EPOCH, *ep'ok,* or **ERA,** a fixed period of time, and the arrangement or grouping of the various great events in the history of the world occurring within that period. The invention of the art of writing provided a means of making permanent records in place of mere tradition; necessarily, the history of the ages before that time is wrapped in obscurity. The Creation and the birth of Christ are the most prominent of the historical epochs. The Creation has formed the foundation of many chronologies, the foremost being the epoch adopted by Bossuet, Ussher and other Roman Catholic and Protestant divines; the *Era of Constantinople* (adopted by Russia); the *Era of Antioch;* the *Era of Alexandria,* and the *Abyssinian Era.* Although varying in date, each of these places the Creation somewhere between 4000 B. C. and 5500 B. C. The Julian period (the suggestion of Joseph Scaliger, in 1582), on account of the possibilities it affords in comparing the different eras with one another and in marking the years before Christ, is generally employed by chronologists. It is the only epoch established on an astronomical basis. The first year of the Christian Era corresponds with the year 4714 of the Julian period.

The Greeks computed their time by periods of four years, called *Olympiads,* from the occurrence, every fourth year, of the Olympic games. The first recorded Olympiad began in 776 B. C. The Romans dated from the supposed year of the founding of their city, April 21, in the third year of the sixth Olympiad, or 753 B. C. The *Jewish Era* places the Creation in 3760 B. C. The *Christian Era,* or mode of *computing* from the birth of Christ as a starting-point, was first introduced in the sixth century, and was generally adopted by 1000. The Mohammedans date from the *Hegira,* or the flight of the prophet from Mecca to Medina in A. D. 622. The years are computed by lunar months. For chronological purposes the Chinese, in common with some other nations of the East in Asia, employ cycles of sixty, by means of which they reckon their days, months and years. See CHRISTIAN ERA; CALENDAR.

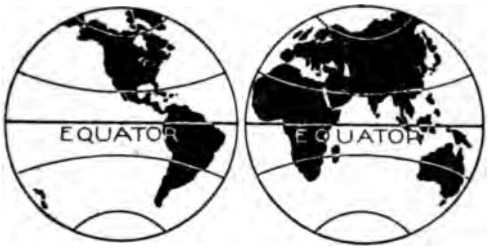
EP'SOM SALTS, medicinal salts composed of crystals of sulphate of magnesium, named after the town of Epsom, England, where it was originally obtained. The chief source of supply is now Stassfurt, in Saxony, where it is prepared from crude salt. It is used in medicine as a purgative and is also an important ingredient in aniline dyes. The War of the Nations cut off the European supply of the salts in 1914, and the deposits in Chile and in the states of Kentucky, Indiana and Tennessee, hitherto undeveloped, assumed great importance.

EP'WORTH LEAGUE, the young people's society in the Methodist Episcopal Church, organized at Cleveland, Ohio, in May, 1889, and officially recognized by the General Conference of the Church in 1892. It was formed by the combination of five young people's organizations in the Church for the purpose of promoting the interest of young people in spiritual life. The work of the League is organized under four departments, namely, the spiritual, the missionary, the social service, and the recreation and culture departments. Every member is assigned to one department and is expected to work in it. Classes in Bible study, missions, good citizenship and social service are formed among the members, and during the summer institutes lasting a week are held in various places. Any member may register to attend these meetings, where classes for study are held and lectures are given in the morning, while the afternoon is spent in recreation.

There are two grades in the League, the Senior and the Junior. Many local chapters add a third, or Intermediate, grade. The membership of the League, which extends not only all over the United States and Canada but also into several foreign countries, numbered about 900,000 in 1917. The headquarters are in Chicago, where the official organ, the *Epworth Herald,* has been published since 1890. D.B.S

EQUATOR, *e kwa'tor,* an imaginary circle girdling the globe at a distance of 90° from the North and South poles, and dividing the

surface of the earth into two equal parts called the northern and southern hemispheres. Degrees of latitude are measured from the equator north or south along imaginary lines running perpendicular to it and converging toward the poles, where they meet. Degrees of longitude are measured along the equator or lines running parallel to it. All places on the equator have days and nights of equal length all the year.



THE EQUATOR

It marks the center of the torrid zone; is 23½° from the Tropic of Cancer (to the north), and the same distance from the Tropic of Capricorn (to the south).

The *celestial equator* encircles the celestial sphere as the terrestrial equator encircles the globe. When the sun is in the celestial equator in spring and autumn, days and nights are equal all over the world. An irregular circle, the line of which runs sometimes north, sometimes south of the equator, is known as the *magnetic equator;* it is about 90° from the magnetic poles. On this line a magnetic needle has no inclination and remains horizontal when free to turn in any direction.

Related Subjects. The reader is referred to the following articles in these volumes:

Aclinic Line	Latitude
Equinox	Zone

EQUESTRIAN, *e kwes' tri an,* **ORDER,** originally the cavalry of the Roman army. Romulus is said to have selected from the three principal Roman tribes a bodyguard of 300 *equites,* or knights, called *celeres.* This number was afterwards gradually increased to 1,800. Until 123 B.C. the *equites* were exclusively a military body. After that time they became a distinct order, non-military in character, and constituted the financial aristocracy of Rome.

EQUINOX, *e' kwi nox,* in astronomy, the time when the sun passes across the equator in one of the equinoctial points; that is, one of the points where the ecliptic, or sun's path, crosses the celestial equator (see EQUATOR). This occurs twice yearly in the sun's apparent journey round the earth. In the spring the *vernal* equinox occurs March 21, the sun entering then what is known as the *first of Aries* (see ZODIAC). The *autumnal* equinox occurs September 22, when the sun enters the *first of Libra.* At these times day and night are equal all over the world. The equinoxes do not divide the year into two equal periods, as the sun, owing to its inclination on its axis, remains longer north of the equator than south of it.

Equinoctial, another name for the celestial equator. The equinoctial points, explained above, move backward at the rate of 50″ every year (see PRECESSION OF THE EQUINOXES). The term *equinoctial gales* is applied to the storms that are popularly supposed to be due to the sun's crossing the equator. There is no reason for such belief, however, and there is nothing in the position of the sun or its effect to cause storms at the equinoxes more than at any other time. C.R.M.

EQUITY, *ek' wi ti,* in legal usage, a body of laws that has been developed to supply certain deficiencies in the common law and to redress certain wrongs for which the common law originally offered no relief. The name is derived from the Latin *aequus,* meaning *fair* or *equal.* The rules of common law, as they were shaped in the early English courts, were intended for universal application, and were accordingly too broad to be applied easily to certain individual cases where injustice was apparent. This resulted in the practice of appealing to the king for relief. Such appeals became so numerous that in the reign of Edward III they were finally referred to a court of chancery.

A typical equity case of early times will serve to show the nature of the relief that was sought. At the time when the common law was being formulated property consisted almost wholly of tangible property, such as lands and goods. Therefore the common law provided that debts might be collected by securing judgment and execution. Later on, however, many other and less tangible forms of wealth appeared, such as contracts, securities, patents, etc., and these could not be seized under the common law. Courts of equity would entertain petitions asking that such intangible property be applied in payment.

The court of chancery established in Edward III's reign remained separate and distinct from the courts of law until 1873, when it became a division of the High Court of Justice. In the United States, chancery courts were in existence in most of the states at the end of the Revolutionary War, but since then they

have been abolished in many states, law and equity being administered by the same judges and courts. In Canada there were originally separate courts of king's bench, *common pleas* and *chancery,* but these have been abolished, and one court can try and determine any case of law or equity that comes before it in due process of law. An exception to this occurs in Prince Edward Island, where the chancery court is still in existence as a separate tribunal.

That equity courts aim at justice is apparent from some of the maxims they have developed: "Equity considers that done which ought to be done"; "No right without a remedy"; "He who seeks equity must do equity." Originally the judges had to consult very largely their abstract ideas of justice in rendering decisions, but in time a great body of precedents and a number of guiding general principles came to be recognized. Courts of equity grant injunctions, clear up defective titles to real estates, appoint receivers, etc. R.E.B.

Related Subjects. The reader is referred to the following articles in these volumes:

Chancery	Execution
Common Law	Judgment
Courts	Law

ERASMUS, *e raz'mus,* DESIDERIUS (1467-1536), the most learned, versatile and beloved of all the scholars who brought about the Renaissance (which see). Few other men of letters have wielded an influence during their own century equal to that exercised by him, yet he was not a creative genius, and he produced no single work which ranks among the world's masterpieces.

He was born at Rotterdam, Holland. Soon after he was ordained to the priesthood he entered the University of Paris. He was seldom connected with any institution of learning, and spent most of his life in France, England, Holland and Italy. Not long after the invention of printing he gave to the world the Greek Testament and a multitude of classical authors in Greek and Latin. His masterpiece, *Colloquia,* of which the first edition appeared in 1519, consists of a series of dialogues on the everyday topics of the time—social, religious and educational. He was intimately associated with Martin Luther, but when the Reformation broke out he gave adherence to neither party. In his *Adagia* and *The Praise of Folly* he showed the need of a general reform in the Church, and because of his stand he became involved in a series of distressing controversies.

Erasmus also contributed considerably to the advance of education. Despite his many conflicts, he enjoyed the friendship of the greatest minds of the day as well as of the crowned heads of Europe, who were proud to do honor to this farsighted scholar, reformer, philosopher and critic.

EREBUS, *er'e bus,* in Greek mythology, is the name of one of the sons of Chaos. The word signifies *darkness,* and is used especially to denote the dark and gloomy cavern beneath the earth to which no gleam of sunshine ever penetrated and through which the shades (spirits of the dead) passed on the way to Hades. It was over this mysterious world that Erebus reigned. Nyx, his sister, represented Night, and was worshiped by the ancients with the greatest solemnity.

ERECHTHEUM, *er ek'the um,* a temple on the Acropolis at Athens, considered the most refined example of Ionic architecture. It was called after Erechtheus, to whom a portion of it was dedicated. It contained the ancient

THE ERECHTHEUM
As it appears to-day.

image of Athene, the salt spring of Poseidon, the sacred olive of Athene, and three altars, one to Poseidon and Erechtheus, one to Butes and one to Hephaestus. It also contained the gold lamp of Callimachus, which burnt for a year without refilling, and had a chimney in the form of a palm tree. The building is square, with porticoes on three sides. The east portico is adorned with six Ionic columns. On the south side at the west end is the famous Porch of the Caryatides. The Erechtheum was damaged by fire soon after it was completed in 406 B.C., but was repaired early in the following century. In Christian times it was used as a church, and under Turkish rule as the harem of the governor of Athens. Since 1900 the project of rebuilding the Erechtheum has been considered. See CARYATIDES; ATHENS.

ERFURT, *er'foort,* a city which may properly be called the home of German flower

is situated in Prussian Saxony. In the th century its woolen and linen manu- es raised it to the position of the most tant commercial town of Central Ger-

It is now noted principally for the fact there are more flower seeds grown in round Erfurt than near any other city in orld; this alone gives it an extensive

An area of about 2,000 acres, growing 9,000 varieties of flowers, are under ation; 750 acres of this area are under

Nearly all the floral novelties of merit, the Burbank varieties, which are offered world can be traced back to Erfurt.

rt boasts of several fine churches, chiefly thic architecture. The town has had a history, being either the source of dis- ces between the electors of Mainz and or the object of attack by foreign in- . From 1378 to 1816 it was a university , of which the Academy of Sciences and rary of about 60,000 volumes and 1,000 cripts alone remain. The monastery, n orphanage, is famous as having been the residence of Martin Luther. The actures are varied, including cloth of s kinds, machinery, shoes, lamps and als. Population in 1910, 111,461.

OT, *ur'got,* a name given to hard, pur- bodies, replacing grain in heads of rye. are caused by a growth of fungus, are much larger than the seeds they re- and they contain an oily fluid. The al supply is derived from the grain- g districts of Russia. Ergot is poisonous, is largely used in medicine; it is danger- its action on the heart, and never should en except under the direction of a physi-

CSSON, *er'ik son,* JOHN (1803-1889), an or and engineer, who revolutionized warfare. Except for him history would ve recorded the critical battle between *onitor* and the *Merrimac* during the f Secession. He was born at Wermland, n, July 31, 1803. In 1828 he made the plication to navigation of the principle lensing steam and returning the water to iler. He also invented a self-acting gun- y means of which naval cannon could be ged automatically at an elevation with- ard to the rolling of the ship. His chief ions are his caloric engine, the screw er, which revolutionized navigation, is turret ships. He moved to the States in 1839 and two years later built the warship *Princeton* for the government. This was the forerunner of the steam fighting ships of the world.

JOHN ERICSSON
Builder of the famous *Monitor*, one of the first iron-clad fighting vessels.

The achievement which made him most famous was the construction of the iron-clad turret ship *Monitor* in 1861, which arrived in Hampton Roads on March 9, 1862, just in time to defeat the Confederate ironclad *Merrimac*. In his later years Ericsson attempted to perfect the solar engine. The centenary of his birth was observed in 1903 in New York by the unveiling of a bronze statue of the inventor in Battery Park; another fine statue was erected at the same time in Worcester, Mass. See MONITOR AND MERRIMAC.

ERIC, *er'ik,* **THE RED** (950?-1000), a Norse explorer and the colonizer of Greenland, was born in Norway, from which country he was compelled to flee to escape a charge of murder. He settled on the west coast of Iceland where, in 984, he was again accused of murder. He then sought refuge in an island which had been discovered a century before, but not settled. In 985 he returned to Norway to secure colonists and supplies for the new settlement, which he called Greenland. This colony did not long survive on the inhospitable shores. His son, Leif Ericson, introduced Christianity into the island, and is credited by some with the discovery of the continent of North America, which he called Vinland. See GREENLAND.

ERIE, *e'ri,* LAKE, the southernmost of the five great North American lakes drained by the Saint Lawrence River. It receives the waters of Lake Huron through the Saint Clair River, Lake Saint Clair and the Detroit River, and discharges through the Niagara River into Lake Ontario. It is 240 miles long and forty miles broad, and covers an area of 9,960 square miles, about that of the state of Vermont. Its surface is over eight feet lower than that of Lake Huron and twenty-nine feet lower than that of Lake Superior (for diagram showing elevations, see GREAT LAKES). Owing to the shallowness of its waters, nowhere more than 200 feet deep,

the lake is quickly stirred by storms and is noted for the violence and height of its waves. The whole of the northern shore is Canadian territory; the southern belongs to the United States. The international boundary divides the lake into two nearly equal parts.

As a commercial highway the lake is of great importance. More tonnage is carried in vessels across Lake Erie in the three months during which grain is being moved from the northwest of America than passes through the Suez Canal in an entire year. The old Welland Canal affords passage for small vessels into Lake Ontario, and when the new canal is completed the largest vessels will be able to pass through it. The New York State Barge Canal (which see) connects Lake Erie with the Hudson River. The principal ports are Buffalo, the great wheat depot for the East; Toledo, Cleveland, Erie and Ashtabula. Navigation is almost entirely suspended during winter. There are numerous islands in the lake, evenly divided between the United States and Canada. The fisheries of Lake Erie are important, the

LAKE ERIE

lesser whitefish being the most valuable food fish. The value of the annual catch is estimated at more than $1,000,000.

Battle of Lake Erie. In the War of 1812 between Great Britain and the United States a naval engagement was fought on September 10, 1813, off Put-in-Bay, near the western end of Lake Erie. After the battle was over, the American commander, Oliver Hazard Perry, wrote on the back of an old letter a message which has become famous: "We have met the enemy and they are ours—two ships, two brigs, one schooner and one sloop. Yours with great respect and esteem, O. H. Perry."

The British had six vessels, under the command of Robert Barclay, a veteran of Trafalgar, while Perry commanded nine. The British at *first* concentrated their fire on Perry's flagship, the *Lawrence,* named in honor of the brave captain of the *Chesapeake.* The *Lawrence* bore the brunt of the battle until only Perry, his twelve-year-old brother, and eight of the crew

BATTLE OF LAKE ERIE

Reproduction of a famous painting by W. H. Powell, now hanging above the landing in the staircase in the Senate wing of the Capitol, Washington, D. C.

were left alive. As the flagship was completely disabled, Perry, with his flag in hand, jumped into an open boat, and was rowed across, under heavy fire, to the *Niagara.* The engagement then became general, and three hours and fifteen minutes after the first gun was fired the British squadron surrendered. The Americans lost 123 men in killed and wounded; the British, 135. Perry's victory was important because it gave the Americans control of the lower end of the Great Lakes, compelled Proctor to withdraw from Detroit, and opened the way for General Harrison's invasion, which ended at the Battle of the Thames. T.E.F.

ERIE, PA., the only lake port of the state, an important railway and industrial center and the county seat of Erie County. It is situated on Lake Erie, on the northwestern boundary of the state, eighty-eight miles southwest of Buffalo, N. Y., ninety-five miles northeast of Cleveland, O., and 148 miles north of Pittsburgh. The city is served by the Bessemer & Lake Erie, the New York, Chicago & Saint Louis, the Pennsylvania and the New York Central railways. Large steamboats ply regularly between Erie and other ports on the Great Lakes, and interurban lines connect with cities as far east as Buffalo, west to Cleveland and south to Meadville, thence west to Linesville. A Federal estimate in 1916 gave the city 75,195 people, an increase of 8,670 since 1910. The area of the city exceeds seven and one-third square miles.

Commerce and Industry. Extensive coal and coke districts in the vicinity and a supply of natural gas increase the commercial and

industrial importance of the city. Besides large exports of coal and iron, there are extensive fisheries and a heavy trade in oil, lumber, agricultural and manufactured products and package freight. The harbor is the largest on the lake, being four miles long and one mile wide, and is protected by the peninsula called Presque Isle, six miles long and one mile wide. Three lighthouses stand at the entrance to the harbor, and substantial wharves extend along the entire front.

The manufactures of Erie are important and varied, the annual output being valued at more than $30,000,000. About 16,000 people are employed in the 450 industrial establishments, the most extensive of which are steam-engine and boiler works. There are manufactories of iron and brass products, paper, railroad cars, rubber goods, air compressors, brick hollow-ware, electrical supplies and agricultural implements; besides these, there are planing mills, oil refineries, tanneries, flour mills, breweries, chemical works, boat-building plants and grain elevators.

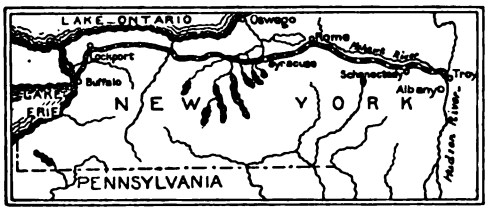
Parks and Boulevards. Erie is located on a bluff which affords a fine view of the lake, and though it is principally a commercial city, it has many beautiful parks and broad streets, lined with handsome residences, fine trees and attractive gardens. About 325 acres are assigned to parks, which contribute much to the beauty of the city, the largest of these being Waterworks Park on Presque Isle, of 150 acres; Waldameer Park on the lake shore is one of the most beautiful natural parks of the country. The Cedars and Lake Side parks are among the pleasure resorts of the city, and Cambridge Springs is a noted health resort in the vicinity.

Buildings and Institutions. The most notable buildings are a Federal building, erected in 1888, a city hall, a courthouse, a $550,000 Commerce Building, constructed of reënforced concrete, a Union Depot, two cathedrals, a Y. M. C. A. building and a Masonic Temple. The benevolent institutions include two hospitals, a sanitarium, eight homes for children and aged people and the Pennsylvania Soldiers' and Sailors' Home.

Education. The public school system of the city, with two high schools and a normal school, is supplemented by Saint John Kanty College; Saint Benedict, Villa Maria and Erie academies, a library with 30,000 volumes, and two business colleges.

History. The old French Fort Presque Isle stood on the site of the present city of Erie in 1753. The English took possession of it in 1760, but during the war of 1763 a large force of Indians compelled the garrison to surrender. The town was laid out and settled by some families from New England in 1795. During the War of 1812, the town was the headquarters of Commodore Perry; the two flagships with which he defeated the British in the naval Battle of Lake Erie, off Put-in-Bay, were built and equipped here, and to Erie the victorious fleet returned with its prizes and prisoners. The town was incorporated as a borough in 1805 and in 1851 was chartered as a city. In 1913 the commission form of government was adopted, with a mayor and five other elective officers. J.S.C.

ERIE CANAL, the first important waterway constructed in the United States, whose completion, in 1825, marked the beginning of a new era in the economic and commercial history of the American people. It extends from



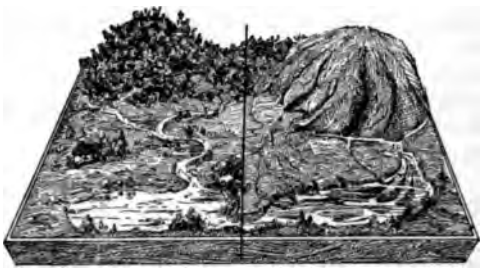
ROUTE OF THE ERIE CANAL
The original canal is now a part of the New York State Barge Canal System.

Buffalo to Troy and Albany, N. Y., connecting Lake Erie with the Hudson River, and originally was 363 miles long, twenty-eight feet wide at the bottom, forty-two feet wide at the top and four feet deep. This great public work, which was built by the state of New York at a cost of over seven million dollars, was for years the main channel through which the raw products of the developing West found their way to New York, and over which the finished products of the East were carried back to Western consumers.

Not only was it the chief single factor in establishing New York City as the leading commercial and financial center of the country, but it was responsible for the building up of a chain of towns and cities through the commonwealth, thus contributing in no small measure to the prosperity and growth of the "Empire State." Between the year 1817, when the work was begun, and 1882, when tolls were abolished, the total revenue from operating the canal amounted to $121,461,891, and during the first ten years after its completion transportation

force than that falling upon slopes covered with vegetation, because the foliage breaks the force of the falling water. The sod formed by roots of grass and the matting of decayed leaves in the forest also absorbs a good portion of the water and allows it to sink into the ground, thus preventing floods. Moreover, a portion of the water absorbed by the earth reappears in springs and streams, feeding them slowly and continuously. Thus forests are valuable agencies in preventing the destruction of the land by erosion, and they should be carefully preserved. This action is shown in the illustration.

Atmosphere. The atmosphere is constantly wearing away the surface of rocks in two ways —by decomposing them and by the action of



MODEL ILLUSTRATING EROSION

The effect of rainfall is shown upon two adjacent hills. One is covered with forest growth, and erosion is slight; the other cannot hold rainfall and deep gulleys result. A model similar to the above can be made for any school.

wind. The decomposition is so slight, however, that it needs no attention here. Wind, especially in the arid regions, is constantly wearing away the surface of the rocks, and in many places wonderful figures are formed in this way. The remarkable natural sculptures found in the Garden of the Gods, Colorado, and in portions of the Bad Lands in South Dakota were formed by the action of wind. Sand dunes, wherever they occur, are also good examples of changes wrought by wind.

Ice. We are familiar with banks of sand and gravel thrown up by ice on the shores of small lakes, but we do not see the actual wearing away of rocks by ice, except in those regions where glaciers are found, as in the Rocky Mountains and the Alps. In the Glacial Period, however, extensive erosion was caused by ice. While erosion was more rapid and more extensive in past geological ages than at present, all forms of it are still active, and may be studied on a small scale in almost every school yard *and on every farm.* C.R.M.

Related Subjects. The reader is referred to the following articles in these volumes:

Alluvium	Glacial Period
Canyon	Grand Canyon of the Colorado
Delta	River
Dune	Valley
Geology	

ERYSIPELAS, *er i sip' e las,* sometimes called SAINT ANTHONY'S FIRE, is a very infectious disease. The name is derived from two Greek words meaning *red skin,* extreme redness and inflammation of the skin being the most noticeable symptoms. The disease is caused by germs which enter the skin through a scratch or cut. It usually appears upon the head or face, and begins with a chill, followed by headache, loss of appetite and a general feeling of illness. The disease does not usually prove fatal. If the infected parts are treated with antiseptic dressings, and the patient takes a tonic, such as iron, strychnine and quinine, improvement will be seen in a few days. Some physicians paint the edges of inflamed spots with collodion, to prevent the spread of the malady. W.A.E.

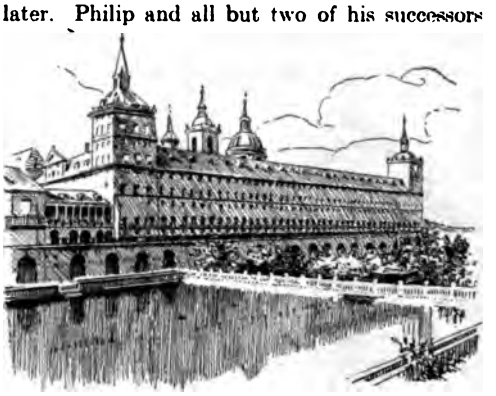
ESAU, *e' saw,* the skilled hunter who sold his birthright to his twin brother Jacob for a bowl of red pottage, because he was hungry when he returned from the chase (*Genesis* XXV, 27-34). Later Jacob, who was jealous of Esau because their father, Isaac, favored him, succeeded in obtaining the parental blessing by deceit, but left the country to escape his brother's anger. Esau with his three wives went to live on Mount Seir, where his descendants formed the nation called the Edomites. Twenty years later Jacob returned and obtained forgiveness for his actions. The reconciliation between the brothers was permanent.

ESCANABA, *es ka nah' bah,* MICH., the county seat of Delta County, on the eastern shore of the upper peninsula, seventy-three miles southeast of Marquette. It is on a promontory at the mouth of Escanaba River, on Little Bay de Noquette, an inlet of Green Bay; the city has a fine harbor. It is on the Escanaba & Lake Superior, the Minneapolis, Saint Paul & Sault Sainte Marie and the Chicago & North Western railroads. In 1910 the population was 13,194; in 1916, 15,485. The area is eight square miles.

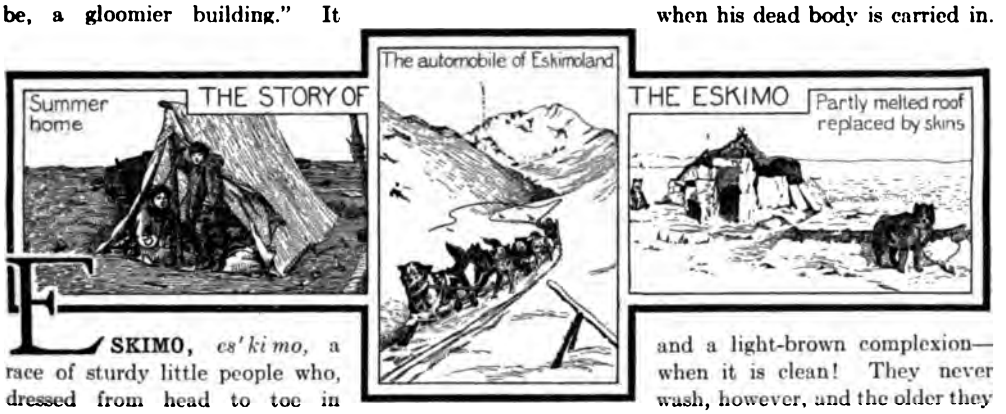
Escanaba was settled in 1863, and was incorporated as a village and chartered as a city in 1883. Picturesque surroundings and excellent fishing and boating have made it a popular summer resort. It contains a courthouse, city hall, public library and a hospital, and is one

of the important ore-shipping ports of the lakes, with especially constructed ore-docks, handling 4,000,000 tons annually. There is also an extensive trade in lumber, fish and coal. The industrial plants of the city include railroad repair shops, furniture, flooring and wooden-ware factories, an ore-crusher and a tie-preserving plant.

ESCORIAL, *es ko'ri al.* Twenty-five miles from Madrid, Spain, is an enormous building, a church, palace and mausoleum, erected by the tyrant Philip II between 1563 and 1584, to the honor of Saint Lawrence, the saint who was roasted on a gridiron. Philip's soldiers having defeated the French on Saint Lawrence's Day, he decreed that this monument be designed in the form of a gridiron. The Escorial is built on a barren hillside, and John L. Stoddard says of it, "There never was, and I hope never will be, a gloomier building." It was begun in 1563 and finished eleven years later. Philip and all but two of his successors were buried in it. The main entrance is opened but twice for each king—on his first visit and when his dead body is carried in.



THE ESCORIAL



ESKIMO, *es'ki mo,* a race of sturdy little people who, dressed from head to toe in warm skins and furs, make their homes principally in North America, in the great snow-and-ice area within the Arctic Circle.

No one knows precisely their origin, but many things about their features, legends and language seem to indicate that they are a primitive American race related to the Indians. Some students, however, believe them to be a branch of the Mongolian family which migrated many centuries ago from Asia into Alaska. The name *Eskimo* is an Algonquin word meaning *eaters of raw flesh,* but they call themselves *Innuit,* meaning *the people.* Although they are scattered over Greenland, Alaska, Labrador, the islands of the Arctic Ocean and parts of Asia bordering on the Bering Sea, the same language is spoken by all the different groups.

Their Appearance and Dress. The Eskimos are rather fat and squat in build. They have wide, oval faces, high cheek bones, flat noses, oblique eyes, straight hair, jet-black in color, and a light-brown complexion—when it is clean! They never wash, however, and the older they grow, the darker and greasier they become.

In the intense cold of the polar regions skins and furs are needed for outdoor wear all the year. Underclothing and stockings are made of the fine skin of the young reindeer. The children sometimes wear bird-skins underneath, with the warm, downy feathers next to their bodies. Trousers of deer or sealskin are tucked into high boots, which are of reindeer skin for winter wear and waterproof sealskin for summer. Several fur jackets are usually worn, the outer one made with a hood. An Eskimo will sometimes wear an extra jacket of fish-skin, which he has been known to eat in an emergency. Boys and girls are dressed alike, and there is very little difference between the costumes for men and women, except that the woman's hood is larger, like a long pocket, and she can carry her baby tucked snugly away in its warm folds.

Their Unique Houses. No trees grow in the far north, but the simple dwelling of the

Eskimo serves even better than a house of wood to keep out the cold. It is a snow house, called an *igloo*—the Innuit word for *house*—

ESKIMO CHILDREN
The boy at the left and the girl at the right are clothed practically alike from head to foot.

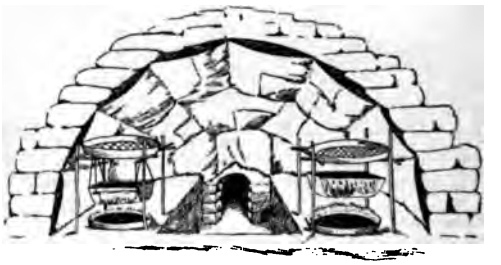
and it forms an important chapter in the story of how man is able to triumph over nature. To build it the Eskimo first saws thick blocks of snow out of a deep, solid drift, taking the circular hollow thus made as the main room of the house. Then the blocks, with snow for cement, are placed in spiral fashion to form the walls. This results in a low, domed hut, partly underground, looking something like a bee-hive (see illustration). It is entered by a long, narrow tunnel, so low that the family must crawl through on hands and knees. Off this passage are the storerooms. Light filters in through the snow walls of the igloo, but sometimes there is a window, with a thin sheet

A WINTER HOME

of ice instead of glass. Air is admitted through a hole at the top of the dome and through the chinks between the blocks.

In Alaska one often sees permanent winter houses built of driftwood, whaleribs, stones and turf, banked with snow, but these materials are not available in all parts of the Eskimo country. In the spring they become too damp for use and are deserted until the next winter.

The Eskimo has no stove such as we know, but he has a very wonderful lamp that gives a good deal of heat as well as light. Upon this lamp depends the family's comfort through the long winter night, lasting almost six months. It is usually made of soapstone, in the shape of a clam shell, has a wick of moss, and burns oil obtained from the blubber of the seal. In the summer the blubber is chewed to extract the oil, and in the winter it is frozen and beaten for the same purpose. The lamp, burning without smoke, makes the igloo so warm that very little clothing is needed; indeed, the heat is great enough to melt the snow walls, which are generally lined with skin in order to protect the inmates from the dripping. When the summer comes and the snow house



INTERIOR OF WINTER HOME

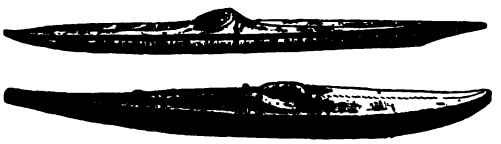
is no longer inhabitable, that same skin will be used for the family tent, for during the summer season the Eskimos keep moving from place to place, hunting game. The furnishings of the igloo are of the simplest kind, consisting mainly of a long bench used both for lounging and sleeping, with whalebone dishes and knives, cups, bottles and baskets of sealskin and other primitive utensils.

What They Eat. The "little frosty Eskimo," as the poet Stevenson calls him, is not "fed on proper meat," but gets plump and strong—and greasy—on a steady diet of fat and oil. In winter the flesh of seal or whale forms the chief dish, with a very little of the precious blubber or fat, that also provides light and fuel. The menu is sometimes varied by walrus or narwhal. It is this fatty food which enables him to endure the severe cold, for fat is a great heat-maker for the body. In summer the hunters travel long distances to find

bear, deer, foxes, hares and birds; some of these delicacies are stored away for the winter. Occasionally the meat is cooked over the lamp, but more often it is eaten raw. Eskimos have enormous appetites, and it is said that two of them can easily consume a small seal in one meal.

How They Travel. The dog is the Eskimo's horse, and the sledge is his moving van, family carriage, automobile and railway train. It can be used all the year except in Southern Greenland. Driftwood, when it can be obtained, makes the runners, which are connected by bone or ivory bars tied with rawhide. However, if you were to go to Eskimo-land you would see many strange substitutes used in sledge-making; for instance, rolls of skins sewed in a bag which is frozen into the right shape, or packs of fish, and even blocks of ice for the body, with frozen fish for runners and the spreading antlers of a deer for a back rest. Four or eight strong, well-trained dogs are harnessed to the sledge with rawhide and are governed by a whip with a very long lash which the driver uses with great dexterity. Those who have read Jack London's *The Call of the Wild* have a fine word-picture explaining how the teams are managed and how careful the driver must be to keep perfect discipline. If one dog bites his neighbor, the second dog takes revenge by biting the one next to him, and so on through the whole pack, until there is a general fight which is likely to result in injured dogs and tangled harness.

Snowshoes are a great help in overland travel. For travel by water the Eskimo has the *kayak,* or fishing boat, and the *umiak,* or family boat, sometimes called the woman's boat. The kayak is a very light canoe made



TWO FORMS OF THE KAYAK

of skin stretched over a frame of bone or wooden ribs. It is often as long as twenty feet, but never more than twenty inches in width. The round opening in the middle where the paddler sits has a sort of cuff which he can button around him to make the boat absolutely water-tight (see illustration). When a boy is ten years old he is taught to use the kayak, and he learns to handle it with marvelous skill, often capsizing it on purpose in order that the bottom may take the shock of a heavy wave, and then quickly righting it again. The umiak is large enough to hold the entire family and all the household belongings. It is flat-bottomed and has a sail as well as paddles.

Occupations and Amusements. The Eskimo must fish and hunt very diligently in order to keep himself and his family supplied with food, clothing and the materials required for their implements. He uses the spear and the harpoon for killing polar bears, seals and whales, and for land game sometimes a modern rifle is employed. In Greenland and Alaska the Eskimos engage in trade with the whites, selling skins, ivory, whalebone and eiderdown.

They are a fun-loving people, fond of music, story-telling and games. One of their favorite pastimes somewhat resembles football, and other popular games are throwing stones at a target, card-playing, wrestling, tossing a perforated bar and catching it on an ivory point, racing, and the like. The children have plenty of sport with tobogganing, hockey, snow-shoeing and snowballing, and they "play dog" with their small sledges and deerskin reins, just as other little boys and girls "play horse."

Character, Religion, Government. Missionaries have brought a great number of Eskimos into the Christian faith, but those who have not been converted still worship the "whale-spirit," and believe in the sea-demons which figure in their folk-tales, and in the power of the "medicine-men" to keep them under control. They are extremely peaceful in disposition, always good-natured, kind and hospitable, readily sharing their goods with one another. Although they live in small groups or villages, there is no central government of any kind, the only rule being that of the family. There is great good-feeling among the different groups, and no one has ever heard of one village making war upon another.

The Eskimo race is apparently dying out, and to-day there are fewer than 30,000 in existence. This is due largely to their ignorance of hygiene, and the introduction of contagious diseases by white visitors, which make it a rare thing for an Eskimo to live to an age of more than sixty years. L.F.

Consult Stefansson's *My Life with the Eskimos;* Nansen's *Eskimo Life;* Murdock's "The Point Barrow Eskimo," in *Ninth Annual Report of the Bureau of Ethnology,* published for the Smithsonian Institution. The latter is a government document.

Related Subjects. The reader who is interested in the Eskimos, their home countries and their mode of living, will find helpful material in the following articles in these volumes:

Alaska	Indians, American
Aleutian Islands	Labrador
Aleuts	Seal
Greenland	Whale

ESKIMO DOG, the beast of burden of the Arctic regions, a strong and fierce member of the dog family, descended from the wolf. It is usually yellow or light gray in color, with

ESKIMO DOG

an outer covering of long hair and woolly fur beneath. The pointed muzzle, pricked ears and bushy tail give it a very wolflike appearance. It is easily trained to hunt and to draw sleighs carrying heavy loads. The Eskimos usually harness from four to eight dogs, abreast, and under favorable conditions these animals will travel sixty miles a day. In Alaska it is customary to harness these dogs, which the white men call "huskies," in single file, usually five or six in a team; often they are harnessed two abreast. In Labrador, six, nine or twelve dogs are used for each sleigh, usually harnessed three abreast. The value of an Eskimo dog varies considerably, ranging from $10 or $15 to as much as $50 or even more, according to strength, training and disposition. Eskimos feed their dogs almost entirely on fish and refuse, but dogs employed by *white men* occasionally get boiled meal.

The dogs are not affectionate and need to be carefully watched. A man walking upright would not be attacked unless the dogs were at the extremity of hunger, but a fall in the snow, putting him at a disadvantage, might

ON A LONG JOURNEY

cause the animals to attack him. Those who have knowledge of the habits of these dogs state that they should always be kept within sight of the driver and within reach of a stout hide whip. The Eskimo dog has short legs, which make it appear smaller than it really is.

ESPAR'TO, a fiber grass extensively used in Europe in the manufacture of paper. It grows chiefly in Spain and Northern Africa, although small quantities are found in dry places in the United States from New England west to Wisconsin. The expense of cleaning it and the cost of transportation make its use impractical in America. This grass, when green, is also used in the manufacture of cordage, matting and similar articles. Cables of esparto grass are used in the Spanish navy, as they are light and will float on the water.

Esparto grass resembles feather-grass. It grows three or four feet high, in clusters from two to ten feet in circumference. The stems are hairy; the leaves are gray-green and they grow six inches to three feet in length.

ESPERANTO, *es per ahn' toh,* a language devised by Dr. Zamenhof of Warsaw, intended to serve as a world language. Under the assumed name of Dr. Esperanto, the originator of the language published his first pamphlet on the subject in 1887; from this the language takes its name. The alphabet consists of 28 letters, 5 vowels (vokaloj) and 23 consonants (konsonantoj):

A a, B b, C c, Ĉ ĉ, D d, E e, F f, G g, Ĝ ĝ, H h, Ĥ ĥ, I i, J j, Ĵ ĵ, K k, L l, M m, N n, O o, P p, R r, S s, Ŝ ŝ, T t, U u, Ŭ ŭ, V v, Z z.

The vocabulary is formed by using first the root words which are common to all the principal European languages; then those that are

all but one, then those that are
all but two, etc. To show the
which words are formed in Esper-
amenhof gives, as an illustration,
·atino, which in reality consists of
, *frat, in, o. Frat* gives the idea of
g of one's parents; *in,* the idea of
sex, and *o,* the idea of existence
thing), hence a noun. These three
ned in Esperanto make *fratino,* a
e first and last make *frato,* a

mar is very simple. By means of
·prepared system of prefixes and
vocabulary may be extended to
nlimited degree; thus *facile* means
facile, with difficulty; dekstre, on
naldekstren, to the left. A great
s and magazines have been pub-
Esperanto. The *English-Esperanto*
s founded by Mr. H. Bolingbroke
November, 1903; this was followed
The British Esperantist, which is
organ of the British Esperanto
There is also an American Es-
ociation, and the Esperanto Society
as been formed. Other languages
with Esperanto for place as an
l language are Volapük, Idiom,
d Bolak, but none of these has
eable gains in a number of years.
e is a revival of interest in it,
nd Volapük, its most notable com-
favor, will fail of their purpose.
K. M.R.T.

ALT, *es'kwe malt,* a city in Brit-
bia, on Vancouver Island, three
of Victoria, with which it is con-
the British Columbia Electric and
an Pacific railways. It is also on
alt & Nanaimo Railway. Esqui-
known as the only Canadian naval
c Pacific coast; it has a graving
epair yards. It is also an impor-
for shipbuilding and salmon can-
imalt was incorporated as a city
ber 1, 1912. Population in 1916,
. G.H.P.

es'a, a literary composition on some
ect, usually shorter and less formal
tise, more loosely constructed than
less argumentative than a thesis,
limited in scope than a biography
"It does not pursue its theme
ter, but goes hither and thither like
find material for its nest, or a bee
to get honey for its comb," is one writer's characterization of it. According to their material, essays can be grouped as historical, political, critical, scientific or personal.

Of the latter type are the essays of Michel Montaigne, the French writer who developed this form of literature. Unlike the novel, the drama or the epic, the essay sprang into being without passing through a long process of evolution, for it came in finished form from Montaigne's pen. His essays are chatty, informal and rambling, and he used the conversational method freely. Informal and intimate, too, are the essays of Francis Bacon, the next great essayist after Montaigne. Bacon, however, put plenty of substance into his essays; he gave them solidity, and through them endeavored to advise and to impart information.

Essays constitute an important part of written English literature. Notable among these are the papers of Steele and Addison in the *Tatler* and the *Spectator;* Charles Lamb's *Essays of Elia;* Macalay's *Milton;* Carlyle's *Burns;* Matthew Arnold's *Sweetness and Light;* Ruskin's *Sesame and Lilies* (a collection of essays); and the essays of Huxley, Newman, Hazlitt, De Quincey, Robert Louis Stevenson and George E. Saintsbury.

Among American essayists, Emerson is the most eminent; probably his best-known essay is *Self-Reliance.* Others who have won honor in this field are Irving, Lowell, Holmes, Thoreau, George W. Curtis, William Dean Howells, Hamilton Wright Mabie, Samuel M. Crothers and Agnes Repplier.

The following essay, by Francis Bacon, is representative of the best work of that author, and is an example of what an essay should be:

Of Studies

Studies serve for delight, for ornament, and for ability. Their chief use for delight is in privateness and retiring; for ornament, is in discourse; and for ability, is in the judgment and disposition of business; for expert men can execute, and perhaps judge of particulars, one by one, but the general counsels, and the plots and marshaling of affairs, come best from those that are learned.

To spend too much time in studies, is sloth; to use them too much for ornament, is affectation; to make judgment wholly by their rules, is the humor of a scholar; they perfect nature, and are perfected by experience; for natural abilities are like natural plants, that need pruning by study, and studies themselves do give forth directions too much at large, except they be bounded in by experience. Crafty men contemn studies, simple men admire them, and wise men use them; for

they teach not their own use; but that is a wisdom without them, and above them, won by observation.

Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse, but to weigh and consider. Some books are to be tasted, others to be swallowed, and some few to be chewed and digested; that is, some books are to be read only in parts; others to be read but not curiously; and some few to be read wholly, and with diligence and attention. Some books also may be read by deputy, and extracts made of them by others; but that would be only in the less important arguments and the meaner sort of books; else distilled books are, like common distilled waters, flashy things. Reading maketh a full man: conference a ready man; and writing an exact man; and, therefore, if a man write little, he had need have a great memory; if he confer little, he had need have a present wit; and if he read little, he had need have much cunning, to seem to know that he doth not.

Histories make men wise; poets, witty; the mathematics, subtile; natural philosophy, deep; moral, grave; logic and rhetoric, able to contend; nay, there is no stand or impediment in the wit, but may be wrought out by fit studies; like as diseases of the body may have appropriate exercises; bowling is good for the stone and reins, shooting for the lungs and breast, gentle walking for the stomach, riding for the head, and the like; so if a man's wit be wandering, let him study the mathematics; for in demonstrations if his wit be called away never so little, he must begin again; if his wit be not apt to distinguish or find differences, let him study the schoolmen; if he be not apt to beat over matters, and to call up one thing to prove and illustrate another, let him study the lawyers' cases: so every defect of the mind may have a special receipt.

ESSEN, *es'en,* the home of the great Krupp gun works, the greatest headquarters for the manufacture of war munitions in the world. The town is in Rhenish Prussia, Germany, northeast of Düsseldorf, in the midst of a rich coal and iron district. Essen grew from about 9,000 people, in 1849, to over 450,000 in 1915, the greater part of this increase being due to the development of the Krupp industries. Over 150,000 people are dependent upon the steel industry alone for a livelihood. In addition to cannon and military machinery of all kinds, the Krupps manufacture railway equipment, motor cars and other steel products.

The idea of an industrial community was conceived by Alfred Krupp in 1848. In its present numerous labor colonies, Essen represents a model industrial center where 30,000 persons are housed under ideal conditions and enjoy many social advantages given to few *workmen* in ordinary industrial communities. It is a national institution in private hands, and Bertha Krupp, daughter of the founder, now Bertha Krupp von Bohlen, who is at its head, is the richest woman in the world. The stock valuation of the company is over sixty million dollars. There are fifteen subsidiary companies, and at least five hundred branches in Germany and other parts of Europe. Although the industrial activity of Essen is recent, the town dates from the foundation of the Benedictine nunnery in 873. See KRUPP, FRIEDRICH ALFRED.

ESTATE, *es tate',* a legal term, used particularly in relation to land, indicating the nature of the right and the extent of interest which a person has in the land he possesses. This term arises from the fact that under the feudal system (which see) the ownership of all land was vested in the king, and all private holders of land were his tenants. The interest a tenant held in the land was called his *estate,* that is, his *status* in reference to it, and this was always less than absolute ownership.

The chief division of estates is into estates of freehold and estates not of freehold. There are three principal kinds of *freehold* estates: The *fee simple* constitutes an absolute ownership, without any restrictions whatever, the owner having the right to dispose of the land as he pleases. The *fee tail* is a freehold under which the owner can bequeath his estate only to some specified group of his descendants, as male heirs, for instance. In America this is practically unknown. The *life estate* gives the possessor an interest in the land or property during his life-time only. The estates which are not freeholds are various forms of tenancies, the difference usually being in the period over which the contract extends, whether for years, for life or from year to year.

ES'TEVAN, a town in Saskatchewan, founded in 1902 and named for Miss Esther Van Horne, daughter of Sir William C. Van Horne. Estevan is in the southeast part of the province, ten miles north of the international boundary, 145 miles southeast of Moose Jaw and 291 miles west of Winnipeg. It is on the Souris River, which is not navigable, and on the Soo line of the Canadian Pacific Railway, and is the terminus of the Estevan branch of the Canadian Northern Railway. It is the center of the lignite coal area of South Saskatchewan, and as the region grows the town will doubtless keep pace with it. Coal

mining and brick and tile making are the only industries of significance, but there are also a number of distributors of implements and other materials required in the neighborhood. The local Dominion building, completed in 1909, and the collegiate institute, erected in 1914 at a cost of $65,000, are noteworthy structures. The town owns and operates its water, sewer and electric light systems. It is the center of a judicial district. Population in 1911, 1,981; in 1916, 2,140. P.C.D.

ESTHER, *es'ter,* the central figure in one of the world's most beautiful stories, a comely Jewish maiden, who became the wife of the despotic Persian king, Ahasuerus, and saved all her nation from destruction. The tale is found in the book of *Esther* (see below). When Esther was left an orphan, her cousin Mordecai took her under his protection and trained her until the time when the king, who had divorced Vashti, sought a new queen; then she was chosen for the high honor. It was not known at the time that she was a Jewess, but later when Haman, who had become the royal favorite, sought to destroy all the Jews, she revealed her nationality to the king and pleaded so successfully for her people that the plotter Haman was hanged on the gallows he had prepared for the Jews.

The Book of Esther, the last of the historical books of the Old Testament, written about 425 B.C., gives the life of the beautiful queen whose name it bears. Its authorship is unknown, and some have opposed including it in the Bible, because the name of God does not appear in it. The great lesson in the book is the overruling power of Providence. The strongest argument for the fact that the story of Esther is true lies in the feast of Purim, which is still observed by the Jews to celebrate the saving of the nation from destruction at the time of Esther.

ESTHETICS, *es thet'iks,* from a Greek word meaning *perceptive,* was applied by the German philosopher Hegel, early in the nineteenth century, to a science of fine arts which he had worked out. Since his time the term has been in general use to designate the philosophy of the beautiful in nature or in art. Though the ancient Greeks did not think of esthetics as a separate branch of learning, this philosophy began with their early speculations on the nature of beauty. Socrates taught that beauty and usefulness were one and the same thing, and that art was simply an imitation of nature.

Many theories are now held concerning the nature of art and beauty. One school considers that the great works of art form the standards of beauty; another, that the most perfect elements of beauty are to be found in the works of nature. In some systems of psychology the feelings are classified as esthetic (feelings of beauty), ethical, social and religious, esthetic being further classified as *elementary* and *higher.* To the former belongs the love of color, tone, line and form; to the latter, the appreciation of painting, sculpture and the other fine arts.

ETCH'ING, a process of engraving metal plates by means of an acid. In ordinary line-engraving (see ENGRAVING) the lines of the design are literally ploughed into the plate by force. In etching, on the contrary, the design is lightly drawn or scratched on the surface of the plate, and is then deepened to the desired degree by the use of acids.

The word *etching* is a form of the Dutch word *essen,* which means *to eat,* for in etching the acid eats away the copper. The plate is first cleaned thoroughly, and is then covered with an *etching ground.* This ground may be made in several ways, but is usually a composition of wax, gum-arabic and bitumen. When applied evenly to the surface of the plate, this ground protects it from the action of the acid, except at those points at which the etcher's needle has cut through it.

The design or drawing may be traced, or it may be drawn directly on the plate; in the latter case it is usually called a *painter etching,* because the etcher is drawing on his plate as the painter does on his canvas. To draw the design in the wax most etchers use needles of varying sizes, but any sharp instrument will do, and Turner, the great painter, engraver and etcher, actually used the prong of an old steel fork. The needle scrapes away the etching ground and leaves a bare copper surface, into which the acid *bites.*

The biting was formerly done with nitrous acid, but a mixture of hydrochloric acid and chlorate of potash is now more commonly used. To get lines of different depth and heaviness it is necessary to give the plate several baths in the acid. Any lines which are already deep enough can be *stopped out,* that is, covered with a varnish or etching ground which keeps out the acid while the remaining lines are being deepened.

As explained in the article ENGRAVING, etching has long been recognized as a legitimate

field for great artists. Many of the greatest painters have done original etching, or have reproduced their own works. Rembrandt is generally regarded as the father of etching, and in the estimation of most artists he is the greatest etcher who has ever lived. Ostade, Ruysdael, Paul Potter and Van Dyck are only a few of the many other Dutch painters who were also great etchers. Of modern etchers who stand in the first rank the world recognizes Sir Seymour Haden, Whistler, Bracquemond, Méryon, Anders Zorn, David Y. Cameron, Frank Brangwyn and Joseph Pennell. W.F.Z.

ETH'ELRED II (?968-1016), an English king known as THE UNREADY because of his inability to accept *rede,* or counsel. He spent most of his reign repelling the repeated attacks of the Danes, relying more on money payments than on arms. In 1002 he ordered the murder of every Dane in England, and from then on the hostility of Sweyn, king of Denmark, was almost unceasing. In 1013 Ethelred was obliged to flee to Normandy, the home of his wife, Emma. The next year, upon the death of Sweyn, he was recalled to his former kingdom. He died in London while preparing to resist another Danish invasion led by Canute, son of Sweyn. One of Ethelred's sons was Edward the Confessor.

ETHELWULF, *eth'el woolf* (? -858), the father of Alfred the Great. During the lifetime of his father, Egbert, he was king of Kent, Essex and Sussex, but in 839 he inherited the crown of Wessex and gave the subordinate dominions to his son Ethelstan. To repel the repeated ravages of the Danes he appointed officers to organize each of the maritime districts, but during his reign the invaders twice reached London. In 856, on his return from a pilgrimage to Rome, Ethelwulf found that his son Ethelbald had usurped his throne. Instead of inspiring a civil war, Ethelwulf resigned his rule over Wessex and took, instead, the kingdom which he had first governed.

E'THER. We are all familiar with the incandescent electric lamp, which consists of a carbon filament contained in a glass bulb from which the air has been removed. We know that such a lamp also radiates heat, so there must be some substance present in which heat waves can travel. We also know that we receive light and heat from the sun, although with the exception of the thin envelope of air the space between the earth and the sun seems to be absolutely empty. Light and heat are *forms of* energy, and we cannot conceive that energy can be transferred from one place to another unless it is transmitted by or through some medium. Scientists have therefore assumed that the seemingly empty spaces in the universe are filled with a substance through which energy can travel. This substance or medium has been named *ether.*

Men of science have devoted much time and research to the study of ether, but up to the present we know very little about the nature of this substance or of its properties. This is not surprising, for this study is connected with the most delicate and abstract problems in physics, such as the constitution of matter, the wonderful power known as electricity, and other fascinating subjects which the mind of man in its desire to discover the secrets of nature is constantly pursuing. For the present let us be satisfied to know that ether is the substance that fills the immeasurable spaces of the universe which separate the heavenly bodies and that it permeates even the smallest particles into which matter can be divided.

ETHER, a colorless, sweet-smelling liquid, whose fumes produce insensibility so complete that under its influence major surgical operations are performed (see ANESTHETIC). An American dentist, William Thomas Green Morton, was the first to use it regularly as an anesthetic. After applying ether in a number of minor operations and in many experiments on animals, he made its value known to the public in 1846.

The chemical name of ether is ethyl-ether. Ether is obtained as the result of the action of sulphuric acid upon alcohol. It is sometimes used as a local anesthetic, producing intense cold when evaporated; if injected under the skin it acts rapidly as a stimulant on the heart and respiration, and is valuable in cases of fainting. Ether is considered a safer anesthetic than chloroform, and is used extensively in surgery. It is liable, however, to have an irritating effect on the kidneys, and to stimulate bronchial trouble; otherwise, its administration is not attended with danger, unless the patient has a weak heart.

Disagreeable after-effects, especially severe nausea, have long been associated with the use of ether as an anesthetic. Various remedies for counteracting this nausea are now being employed. European physicians favor injecting into the veins or muscles the anesthetic diluted with a saline solution. An expedient introduced recently into America consists in the injection of ether mixed with olive oil into

the lower bowel. If the anesthetic is freed from all impurities before it is administered the patient is much less liable to suffer from nausea on regaining consciousness. Since the middle of the nineteenth century ether has been used to some extent in Ireland as an intoxicant. The effects are similar to those attending the use of opium.

ETHICS, *eth'iks.* Questions of right and wrong are woven into all conversation; they are as close to our life as the air we breathe. Should I buy this expensive coat? Is it right for Harry to go with the boys with whom he associates? Should Mary stay out of school to work? Each of these questions includes the problem of right and wrong. Questions of this nature are constantly confronting us in the home, in the school, in society and in the world of business. How may we find the right answer to them? What should constitute the underlying principles by which the moral problems of our lives and of society are solved?

So important are such questions held to be that a complete "science of right and wrong" has grown up, which has for its purpose the solving of them, and this science is called *ethics,* the name being derived from a Greek word meaning *character.* The student of ethics must not expect, however, that his specific moral problems will be solved by a study of this science. Ethics endeavors to answer such questions along general lines, but it does not, and cannot, answer specifically each question, for two reasons:

1. "Because each life, and so the right choice in any life, is different from any that has been made before."

2. "Because of the wide difference in opinion it is impossible to tell offhand what morality should be. We can, however, tell what morality has been and is. We can assert, for instance, without fear of contradiction, that murder, lying and theft are wrong, and that kindness, truthfulness and honesty are right."

Everyday Phases. As a science, ethics finds no place in the list of studies until college days are reached; but long before school days begin every child must have been made acquainted with many of the most important ethical principles. The instructor or the mother who teaches a child to be habitually courteous, unselfish, kindly and self-controlled is giving instruction in just those fundamentals which scholars and philosophers have laid down as the basis of ethical conduct. That such training is the most important part of her work, every mother and teacher recognizes.

The teachers and mothers recognize, too, that for such moral instruction no hard and fast rules can be laid down. Age, disposition, circumstance—all these determine in large measure the course it shall take; but the following suggestions will be found helpful by anyone who has to deal with children.

1. The child is a creature of impulse and often needs help in gaining that self-control necessary to a stable character. "I didn't think," or "I did it before I thought," is his frequent excuse when his acts are called in question. At this stage he needs guidance rather than censure.

2. Use every right effort to fix in the minds of children high ideals and right principles of living, so when they leave home and school they may be able to withstand the temptations that confront them.

3. The higher emotions will displace the lower—love will drive out fear, and sympathy will allay angry passions; therefore cultivate the higher emotions.

4. Moral training to be effective must be positive, not negative. Lead children to see and choose the right. Give them opportunity to discuss questions of a moral nature whenever they are in doubt about them.

5. See that children are provided with wholesome recreation, and such work as they have the capacity to do. Not only an "idle brain," but idle hands, as well, are the "devil's workshop."

6. Let the atmosphere of the home and the school be such as to strengthen all right impulses and higher emotions.

7. It is by the choices and acts of everyday life that character is formed, more than by great crises. Through his daily tasks and decisions the youth fortifies himself to withstand the crisis when it comes.

8. Make use of stories and the great characters of literature as incentives to a noble character. The myth and the fairy tale when wisely chosen leave the child with the desire to emulate the good and beautiful character that dominates the story. Such characters as Gluck in *The King of the Golden River,* Ernest in *The Great Stone Face,* Ellen in Scott's *Lady of the Lake* and many others that might be named exert a powerful influence on boys and girls in the "'teen" age.

9. Train for active life; strength of character is seldom developed in seclusion. The Great Teacher prayed, not that His disciples might be taken out of the world, but that they might be kept from the evils of the world, that they might discharge their duties in mingling with men, and at the same time be unscathed by the temptations and evils with which they were surrounded.

"A talent may be developed in solitude, but character only in the rush of the world."

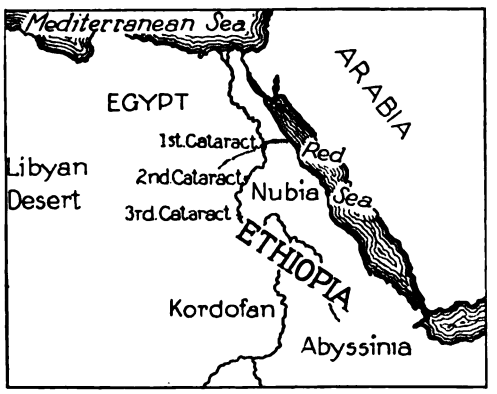
Consult Larned's *A Primer of Right and Wrong;* Cabot's *Every-day Ethics;* Rickaby's *Moral Philosophy, or Ethics and Natural Law;* Royce's *The Philosophy of Loyalty.*

Related Subjects. The following articles in these volumes contain material which is more or

less closely related to the general subject of ethics:

Baby	Judgment
Child	Personal Liberty
Child Study	Psychology
Education	Reason
Feeling	Sociology
Free Will	Theology
Habit	Will

ETHIOPIA, *e thi o'pi a,* in ancient times a vaguely defined country south of Egypt, including present-day Nubia and perhaps Abyssinia and Kordofan. The name itself, derived from two Greek words meaning *sunburnt faces,* is



ANCIENT ETHIOPIA

Its northern boundary is believed to have been close to the dotted line in the map, south of the first cataract.

evidently an allusion to the dark skins of the natives. Whether the Egyptians civilized the Ethiopians or whether they themselves owed their ancient culture to the Ethiopians has long been a subject of dispute, but excavations now in progress will probably answer all such questions. The two countries were closely connected, geographically, socially and commercially. About 1600 B.C. Ethiopia became an Egyptian province, but eight centuries later the condition was reversed, and Ethiopian kings ruled Egypt until about 660 B.C. In 524 Cambyses, king of Persia, invaded the country and captured Napata, the capital. Later the seat of the kingdom was at Meroë, farther south. Northern Ethiopia was part of the Roman Empire, but Meroë maintained its independence until the rise of the Christian state of Nubia, in the sixth century A.D. See ABYSSINIA.

ETHNOGRAPHY, *eth nog'ra fi,* the science that describes the various races, tribes and nations of men. Ethnography is a branch of anthropology, which treats of mankind as a *whole, its* origin and its development, in language, art, religion and political ideas, from barbarism to civilization. Ethnography deals chiefly with the assembling of facts regarding the families, tribes and races of mankind, and seeks to explain the significance of the information secured. The ancients were interested to some extent in the study of foreign races, but not until the discovery of America did the civilized peoples make systematic efforts to study other races. The great governments of the world have now established bureaus for the purpose of investigating their own primitive races and the different peoples that come under their rule, and also the tribes and clans of other nations. See ANTHROPOLOGY; ETHNOLOGY.

ETHNOLOGY, *eth nol'o ji,* the branch of anthropology which seeks out the conditions which produce the customs, laws and habits of nations, the influence they exert on the destiny of commonwealths and the principles of life which they illustrate. Ethnology explains the social life, physical conditions and stage of culture of the various tribes of men, with the aim of defining, by a comparison of such facts, the universal laws of progress of the human species. It explains how language, the arts, food supply, laws and religion exercise their influence on men and on nations. Ethnology and ethnography occupy a relation to each other somewhat like that of geology and geography; ethnography deals with existing facts, while ethnology attempts to investigate the factors which produced them. Thus, the Bureau of American Ethnology at Washington studies the past of the American Indian. See ETHNOGRAPHY; ANTHROPOLOGY.

ETIOLATION, *e ti o la'shun.* Certain vegetables, such as celery, asparagus, cauliflower, endive and chicory, are more tender and desirable for the table when whitened than when bearing their natural green. By banking dirt about the stalks of celery, or by pulling the leaves of cauliflowers over the heads, market gardeners shut the sunlight from vegetables and so prevent the formation of the green coloring matter called *chlorophyll.* As a result the cell walls do not grow as thick as usual.

This blanching of vegetables is but one form of *etiolation* (which is the French word for blanching). Etiolation should be carefully prevented in the growing of grains. If grains are sown too thickly the bases of the stems will be shaded so much that blanching will naturally result, and the cells there will not be

strong enough to bear the weight of the grain heads when winds blow. See CHLOROPHYLL.

ETIQUETTE, *et'iket,* a word of French origin, originally applied to the ticket or label attached to bags and bundles for the purpose of identifying their contents; in its present usage it signifies those niceties of behavior that stamp or label one as understanding the requirements of correct deportment.

Society has worked out for itself rules of behavior for all phases of human activity—social and business intercourse, dining, dressing, corresponding, etc. The well-bred person is the one who understands these requirements and who puts them into practice with naturalness, grace and ease. Good manners are of course indispensable in society, and they have a very practical value in business life. Whether one is beginning a business career or is well established in some vocation, good breeding is a most helpful equipment. Ignorance of the requirements of good form has often caused a young man's sterling qualities to be overlooked.

Etiquette, however, is more than the formal observance of social customs. It is founded on kindliness and consideration for others and true courtesy of the heart, qualities that James T. Fields describes in these words:

How sweet and gracious, even in common speech,
Is that fine sense which men call Courtesy!
Wholesome as air and genial as the light,
Welcome in every clime as breath of flowers—
It transmutes aliens into trusting friends,
And gives its owner passport round the globe.

Washington's Rules of Civility. There is preserved in the state archives at Washington, D. C., in the handwriting of George Washington, an interesting manuscript book containing, among other exercises, a list of rules of behavior. The book bears the date 1745, showing that the compiler wrote the rules when he was a lad of fifteen. What the later Father of His Country considered to be "decent behavior in company and conversation," to use his own words, is suggested by the following extracts:

Every action done in company ought to be with some sign of respect to those that are present.

In the presence of others sing not to yourself with a humming noise or drum with your fingers or feet.

When you sit down, keep your feet firm and even, without putting one on the other or crossing them.

Undertake not to teach your equal in the art himself professes; it flavors of arrogancy.

Give not advice without being asked and when desired do it briefly.

It is unbecoming to stoop much to one's meat. Keep your fingers clean and when foul wipe them on the corner of your table napkin.

Labor to keep alive in your breast that little spark of celestial fire called conscience.

ET'NA, also spelled **AETNA,** is one of the most celebrated volcanoes in the world, and is situated in Sicily. No other mountain has excited the wonder, admiration, dread and superstitious awe that Etna has inspired. Its

LOCATION OF MOUNT ETNA

summit is nearly 11,000 feet above the sea, and its base, with a circumference of over 100 miles, is washed by the waves of the Mediterranean Sea. Its top is crowned with perpetual snow, its vast slopes covered with forests; and spreading orchards, vineyards and orange groves at its base form a picture of rare beauty. There are two cities, Catania and Acireale, and sixty-three towns or villages on Mount Etna, and the region is the most densely-populated of any part of Sicily. The first recorded eruption of Etna occurred in the eighth century B. C. Of about eighty eruptions since then, many have been of extreme violence. In 1669 there was an earthquake during the eruption, when over 20,000 lives were lost. A remarkable feature of Etna is the large number of minor cones, all of volcanic origin, that are scattered over its sides. Recent eruptions were those of 1874, 1886 and 1911. The last-named was more violent than any other for over a hundred years; a lava stream nearly half a mile wide flowed into the valley below.

In legend, Etna was the mass of rock which Zeus heaved upon the giant Typhon; it was also the workshop of Vulcan and the Cyclopes.

E'TON COLLEGE, the most famous of all English public schools, now attended largely by the sons of royalty and of the nobility. It was founded in 1440 by Henry VI, under the name of the "King's College of Our Lady of Eton beside Windsor," and was originally endowed from revenues confiscated from priories by Henry V. The increase in value of property and further endowments have made the college one of the richest educational institutions in the world. The object of the college when established was to educate twenty-five boys, sons of indigent parents, and to support an equal number of poor men. In 1443 it was decided that tuition pupils should be admitted. These were at first called commoners, but are now known as "oppidans," and because of the expense only sons of wealthy parents are now among the student body. Tuition fees range from $800 to $1,000 per year.

Many of England's most famous statesmen and soldiers received their early education at Eton. The Duke of Wellington, a distinguished Etonian, said that the battles of England were won on the football fields of Eton and other English schools, where athletics are considered of the greatest importance in building strong men, bodily and mentally.

ETRURIA, *e tru'ri a,* in ancient geography, a division of Italy, north and west of the Tiber and west of the Apennine Mountains, and including the valley of the Arno. Modern Tuscany and the northern half of the province

ANCIENT ETRURIA

of Rome cover about the same territory. Etruria proper contained a confederation of twelve cities, each of which was independent. The people of Etruria, called *Etruscans,* were the most advanced of any in Italy before the *rise* of Rome. They had magnificent cities and a highly-developed political organization. At the height of their power, about 500 B.C., they controlled Corsica and were the allies of Carthage. The Tarquins (see TARQUINIUS, LUCIUS), legendary tyrants of Rome, were probably Etruscans, and with their expulsion began a struggle between Etruria and Rome which lasted until the former became virtually tributary to the latter in 309 B.C. See ETRUSCAN ART.

ETRUSCAN, *e trus'kan,* **ART.** The art of the people of ancient Etruria (which see), embraced vases done in clay and terra cotta, casting and chiseling in bronze and stone and exquisite pieces of jewelry, gems and coins. From these (except the vases, which are Greek), as well as from the mural paintings found in their tombs and from their work on sarcophagi and cinerary urns, is learned the life, customs, religious creed, costumes, etc., of the Etruscans. The gems consisted usually of carnelian or banded agate, cut in the form of beetles and having a flat face on which a design was engraved. Etruscan jewelry consisted of two kinds—domestic and sepulchral. Of the latter many fine specimens remain, especially the wreaths of gold leaves which encircled the helmets of their warriors.

Etruria! beneath thy magic hands
Glides the quick wheel, the plastic clay expands.
Nerved with fine touch, thy fingers, as it turns,
Mark the nice bounds of vases, ewers, and urns.
—*Darwin.*

ETYMOLOGY, *et i mol'o ji.* Words are always living, growing, changing. They have individualities and personal histories, just as human beings have, and one of the most fascinating of all the sciences is that which traces words back to their earliest sources and follows their changes in form and meaning through the centuries. Such study of the origin and history of words is called *etymology,* a name coming from two Greek words meaning *true account.*

The Purposes of Etymology. In this very derivation of the word we have an illustration of simple etymology, making us better able to understand the term and to use it correctly. These are the chief reasons for learning a word's etymology, although the one who is a specialist in philology can use his knowledge in establishing relationships among the different races of the earth (see PHILOLOGY). Everyone interested in building up a large and accurate vocabulary should use a dictionary that not only gives the meaning and pronunciation of

ı but their derivation as well, and should ıto the habit of noticing the elements of ı they are built. By following this plan, study soon becomes as delightful and bing as a game.

ree Interesting Word Histories. A boy ng for his gymnasium class may wonder the word *gymnasium* really means. If nsults a complete dictionary, he will learn it comes from a Greek root meaning *l;* and if he has studied a little about c life and customs he will recall that the and young men of Greece wore no cloth- hen they took part in athletic games and ises. A girl attending church or Sunday- l finds her attention caught by the quaint- ng word *gospel,* and begins to wonder as ; origin. If when she reaches home she mbers to get out the big dictionary, she ɔe able to trace the word back to the old ı compound *god-spell,* meaning *God-story,* 'orever afterward it will be invested with ːr significance and interest for her. An- word with a life story is *tribulation,* ı comes from the Latin *tribulum,* the given to the iron-studded flail the Ro- used for threshing grain. With this ety- gy in mind, our English word suggests the re of a person suffering the pains of one is being beaten with a flail.

ere are thousands upon thousands of words nglish which have just such interesting ries—fascinating little stories which are ıted briefly in every unabridged dic- ry.

ymology and History. "The study of ;," says Professor Kittredge of Harvard, he study of the history of civilization." ıtudy of English words goes hand in hand the study of English history, showing how anguage has changed with the successive ions of the Romans, Saxons, Danes and ıans. To illustrate: the Latin word for a ied camp is *castra.* During the five cen- ı the Romans ruled over England this was added to Celtic roots to designate ifferent camps, which gradually grew into ;, giving us such names as Lancaster (land- ı) and Manchester (man-castra). The sh affix for *town* was *by,* and names like by and Derby testify to the effect Danish ıpon the Saxon language which, by crowd- ɔut the ancient Celtic, had become the h of all England.

e Long Road Words Travel. English study will take us even beyond the be- ginnings of English history, as such—back to ancient civilizations whose languages show kin- ship with the English tongue. For students of etymology have been able to show that the Sanskrit, Persian, Greek, Latin, Celtic, Slavonic and Teutonic groups of languages have points of resemblance that prove they developed from a common source. Our word *mother,* for ex- ample, has such close relatives as the Anglo- Saxon *mōder,* German *Mutter,* Icelandic *modhir,* Swedish and Danish *moder,* Gaelic *mathair,* Latin *mater,* Italian and Spanish *madre,* French *mère,* Lithuanian *mote,* Polish *matka,* Persian *mader,* Sanskrit *mata,* and many others among the different languages of the earth.

Some Peculiar Changes in Meaning. Since etymology in its widest sense follows a word through all the different shades of form and meaning it has assumed as it has traveled down the ages, it reveals many words whose original significance was utterly different from their present meaning. A most interesting example is the word *depart,* which once meant *divide* or *separate,* so that the old English marriage service read "till death us depart." A *jig* was a fiddle to whose music the country-folk danced. *Imp* originally meant simply *child,* and prayers offered for the health of the Prince of Wales used to refer to him as "that most angelic imp." *Wretch* was a term of affection, a *miser* was a person in misery, and an *idiot* simply a private individual not taking part in public life.

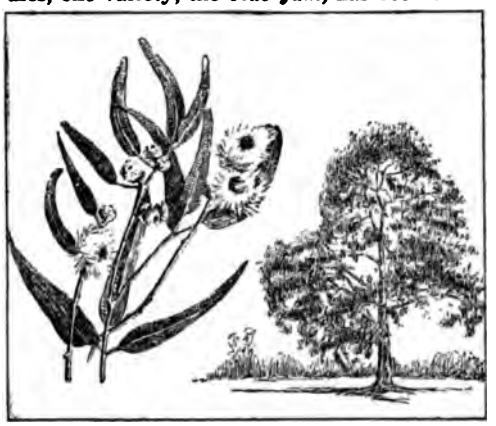
Thus we see that, instead of being a dry, dull subject, etymology is as full of charm and interest as a book of tales. Once a student gets accustomed to looking up the true derivation of the words he meets, he has "the dictionary habit" in its best form and finds new interest and profit in every page he reads. See DICTIONARY. L.M.B.

Consult Bradley's *The Making of English;* Skeat's *The Science of Etymology.*

EUBOEA, *u be'a,* the largest of the Grecian islands in the Aegean Sea, 100 miles in length and in one place about thirty-three in width. It is mountainous in character, but has fertile valleys which produce olive oil, wheat, fruit and honey. The chief towns are Chalcis and Carystus. The inhabitants of Euboea have engaged in cattle-breeding since prehistoric times, the very name meaning *rich in cattle.* The history of the island includes its early occupation by the Abantes and Ionians, its subjugation by Athens after the Persian Wars

and its conquest in 1470 by the Turks, in whose possession it remained until the Greek revolution. In 1830 it was made a department of the new Greek kingdom. It was an ancient intellectual center, and for a long time was the home of Aristotle.

EUCALYPTUS, *u ka lip' tus,* a tree of great commercial and ornamental value. It is a native of Australia and other warm climates, but as it grows rapidly and can be put to many uses, one variety, the *blue gum,* has been cultivated in California, Arizona and Florida. Four to six years after planting it can be cut for fuel; after twenty to thirty years it is fit for saw timber. It has been found that eucalyptus will thrive well where the temperature does not fall below 22° F. for long periods. The trees are remarkable for their gigantic size, some reaching the height of 450 or 500 feet, or nearly the height of the Washington Monument. The leaves are long, narrow, leathery and unsymmetrical, so placed on the stem as to present an edge towards the sun as protection against the heat. The flowers are white, bell-shaped and filled with nectar.



THE EUCALYPTUS
Branch, with leaves, flower and fruit. The picture at the right shows the usual appearance of the tree.

Uses. Eucalyptus trees absorb a great deal of moisture and have been found valuable for planting in malarial districts; they therefore prevent to some extent the development of mosquitoes. As lumber for shipbuilding, railroad ties, paving blocks and for telegraph poles and piers, the eucalyptus is unexcelled. Due to the large amount of astringent resin in eucalyptus wood, it resists attacks of shipworm and other borers, and so is especially adapted for use under water. In California it has brought as high as $100 to $125 per thousand feet. As fuel it brings from $3 to $5 a cord on the stump. The bark of some species furnishes tannin; that of the "stringy bark eucalyptus" produces fibers for cordage, paper and building-thatch.

Eucalyptus leaves are valued for the oil they contain, which has a camphorlike odor and is used as an antiseptic and a stimulant, for dressing wounds and for diseases of the lungs and throat. At the University of Melbourne, Australia, Dr. Richard Bull discovered that eucalyptus oil is a positive destroyer of the germ of cerebrospinal meningitis, a disease long thought incurable (see MENINGITIS). M.S.

Consult *Arizona Experiment Station Bulletin 60; California Experiment Station Bulletin 196;* United States Department of Agriculture *Bulletins 35* and *87.* The former may be secured by addressing the Stations in the states named; the latter may be secured from the Forest Service Bureau of the Department of Agriculture, Washington.

EUCHRE, *u' ker,* a card game probably of German origin, played by two or more persons, with a pack of ordinary playing cards, with or without the joker. All cards between the aces and sevens are taken out, and sometimes the sevens and eights are also discarded. The players cut for deal, and the one deals who draws the lowest card. If four are playing the two opposite players become partners. The dealer gives five cards to each player, at first three and then two. He turns up the top card of those remaining as trump card. If a jack turns up it counts one to the dealer.

The knave of the suit turned up is called the *right bower,* and becomes the highest in the pack except the joker. The next highest card is the other knave of the same color, called the *left bower.* Other cards count in the usual order, aces being higher than kings. The player next the dealer has the option of ordering the dealer to discard one card and take up the trump card or of *passing.* If he *orders up* he must take three tricks or be *euchred* and give two points to his opponents. If all pass, the dealer either accepts the trump or turns it down; in the latter case the next player has the option of declaring trumps from some other suit in his hand. If a player has a strong hand he may play alone, without any assistance from his partner, who discards his hand. If the lone player scores all five tricks (a *march*), he counts four; for three tricks he counts two; if he wins less than three he is *euchred.* If the maker of the trump does not choose to play alone the count is two for five tricks taken,

or one for three tricks. The object is, with or without help from the partner, to score at least three out of five tricks. A game is ten points, unless some other arrangement is made. A player must always follow suit when he can.

Consult *Hoyle's Games.*

EUCHARIST, *u'ker ist,* a Greek word meaning *thankfulness* or *thanksgiving,* and used in the Christian Church to refer to the sacrament instituted by Christ at the Last Supper with His disciples. At that time, when partaking of bread and wine, He said, "This is my body. This is my blood." In Protestant churches it is generally referred to as the *Lord's Supper,* in the Roman Catholic as the *Blessed Sacrament.* Protestant rituals include a frequent observance of the sacrament. All Roman Catholics who have attained use of reason must receive Communion during Pascal season; but weekly, even daily, Communion is common. G.W.M.

EUCLID, *u'klid,* OF ALEXANDRIA, a Greek whose text-book on elementary geometry, written twenty-two centuries ago, is still in use in schools. In England, in parts of Canada and in some other countries boys and girls do not say, "I must study my geometry," as in the United States, but, "I must study my Euclid." The *Elements* of the famous geometrician consisted of thirteen books, or perhaps of fifteen, but as a rule only six books are studied.

Of Euclid's life little is known. Most of our information is gained from the commentary by Proclus written seven centuries later than the *Elements.* Proclus says that Euclid lived in the time of Ptolemy I, who reigned from 323 to 285 B.C. He tells that when the king asked if there were not an easier way to learn geometry than by the study of the *Elements,* Euclid answered, "There is no other royal road to geometry."

EUGENE, *u jeen',* ORE., the county seat of Lane County, a city in the west-central part of the state, situated on the Willamette River at the head of navigation. Its supporting industries are lumbering and agriculture. Portland is 123 miles north. Eugene is on the main line of the Southern Pacific, from San Francisco to Portland, is the terminus of the new branch to Coos Bay on the Pacific coast, and is served by two electric lines. The population in 1910 was 9,009; in 1916 it was estimated to be 13,572.

Eugene is situated in a natural amphitheater, partially surrounded by low hills of the Cascade Range, whose white peaks are visible in the distance. It is the land of the Douglas fir, and according to government figures there are in Lane County, which is approximately the size of the state of Connecticut, sixty billion board feet of America's greatest all-utility wood. Eugene is the commercial center for the industries of fruit raising, diversified farming and mining (gold and silver), carried on in the upper part of the fertile Willamette valley. The industrial enterprises of the city are canneries; flouring, woolen, saw and planing mills; sash, door, furniture and excelsior factories; iron works; machine shops; tanneries; and brickyards.

The University of Oregon (which see), attended by about 1,500 students, and the Eugene Bible College are located here. In addition to the buildings of these institutions there are a Federal building (occupied by offices of the Forest Service and by the post office), a Carnegie Library and two hospitals. The parks of the city are spots of natural, rugged beauty.

Eugene was settled in 1854 and incorporated in 1864. The city is governed under a charter of 1893.

EUGÈNE, *u jeen',* FRANÇOIS (1663-1736), called PRINCE EUGÈNE OF SAVOY, was an Austrian general who shared with the Duke of Marlborough the honors of the War of the Spanish Succession (see SUCCESSION WARS). Prince Eugène was one of the greatest military leaders of modern times. He was a Frenchman by birth, but early in his career renounced his allegiance to King Louis XIV because the latter had refused him a commission, and he joined the Austrian army. At the outbreak of the War of the Spanish Succession he invaded Italy and routed the French at the battles of Chiari and Luzzara. Later he joined Marlborough in Germany, and their united forces won the Battle of Blenheim, the "famous victory" of Southey's poem. By his victory at Turin in 1706 Eugène drove the French from Italy. With Marlborough he won the battles of Oudenarde and Lille in 1708, and that of Malplaquet in 1709. In a later war against the Turks he was equally conspicuous. The last years of his life were devoted to art and literature.

EUGENICS, *u jen'iks.* There are various sciences which devote themselves to unusual subjects—sciences which make a study of shells, of word-endings or of the fossil leaf-forms found in the rocks; but surely the most curious of all is the "science of being well born." This nearly new science is called

eugenics, from a Greek word meaning *good birth*. Most sciences concern themselves not with what ought to be, but with what is; but eugenics combines the two ideas. It declares that every child has a right to be well-born—to enter life without unnecessary handicaps; and it sets itself so far as possible to bring this to pass.

First of all, there are certain definite laws of heredity which are used as a basis. Stock-breeders and plant-breeders have long taken advantage of these to produce better and better plants and animals. By allowing only the most perfect specimens to reproduce, they do away with certain weaknesses and strengthen the good points; for it is a well-established fact that every living thing, whether plant or animal, receives its every characteristic from its ancestors, the most from those closest to it in point of time, the rest in ever-lessening degree from those further back. Everybody knows of the wonderful effects Luther Burbank has achieved in the plant world by making use of these principles (see BURBANK, LUTHER).

Now, scientists know that just as wonderful results could be achieved with human beings, if it were possible to control their lives in somewhat the same way. If none but strong, well-grown, intelligent men and strong, beautiful, intelligent women were allowed to mate and have families, within a few generations there would be practically no weaklings, whether in mind or in body. But, after all, there is a difference in dealing with human beings and with plants or animals; all human beings insist on mating from choice and not because any body of scientific men, no matter how good judges they may be, have chosen suitable mates for them. Even the most enthusiastic advocates of eugenics realize, therefore, that the science can never come to exercise any official control; but by the spread of the doctrines, which are not theories, but certainties, they hope to achieve much for future generations.

The legislature of the state of Wisconsin in 1913 passed a stringent law requiring a physical examination of the male applicant for a marriage license. This law was upheld by a decision of the supreme court of the state. Oregon and Pennsylvania have enacted similar laws, though less stringent as to the physical tests to be passed. Various other states have laws forbidding the marriage of insane, epileptic, feeble-minded and others physically or morally unfit for marriage. A beneficial result of the agitation and discussion aroused by the passage of such laws is that many people have come to see for themselves the necessity for such precautions. It is only in the United States, however, that drastic legislation like that of the state of Wisconsin has made any headway.

In one way, eugenics to-day has more to contend against than it would have had in times past. The ancient Spartans, for instance, allowed all the weak, imperfectly-formed babies to die, and thus built up a race which physically was almost perfect (see SPARTA). But the charitable attitude of modern times toward such weaklings demands that they shall receive more care and attention than the stronger children, and thus they often grow up to marry and have children who are even more defective than themselves. On the other hand, the frequent wars of antiquity killed off many of the finest physical specimens and thus helped to produce a smaller, feebler race. A war which causes many deaths is certain to have that effect; and if, in the minds of the skeptical, eugenics should need any proofs of its principles, these will without doubt be found in plenty in population conditions in Europe during the generations following the destructive War of the Nations.

It may well be pointed out that a distinction is made between *negative* eugenics and *positive* eugenics, the former seeking to prevent the multiplication of the unfit, the latter to encourage the multiplication of the fit. Negative eugenics calls for a considerable use of law. The unfit are often beyond the reach of a sense of responsibility for their offspring, and hence they can be controlled only by such policies as segregation, sterilization, etc. On the other hand, there is little room for law in encouraging superior persons to marry early and have normal families. With such, the motive will be the appeal of eugenics as an ideal of life. For positive results, therefore, the hope is in diffusing among the finer members of the race a sense of their obligation to transmit their inheritance and a pride in becoming parents of healthy, beautiful and intelligent children. E.A.B.

For a more extended study of the subject the reader is referred to Davenport's *Heredity in Relation to Eugenics;* Guyer's *Being Well Born; Eugenics Record Office Memoirs* (Cold Spring Harbor, N. Y.); Jewett's *The Next Generation.* An extensive bibliography entitled *Eugenics and Social Welfare* has been published by the New York State Board of Charities.

Related Subjects. The reader interested in eugenics will find further material of interest in the following articles in these volumes:

Baby	Environment
Breeding	Galton, Francis
Child	Heredity

EUGÉNIE-MARIE DE MONTIJO, *uh zha nee' mah ree' de mon tee'ho* (1826-), widow of Napoleon III, was born at Granada, Spain, and is of Spanish and Scotch extraction. In 1853, as wife of Napoleon III and empress of the French, she inaugurated in Paris a reign of frivolity and extravagance. Clever and fascinating, her influence over the emperor contributed to his downfall and was responsible for many of his political mistakes. Among these were the unfortunate Mexican expedition of Maximilian, which resulted in his death, the failure of the plans for the freedom of Italy, and, as a supreme catastrophe, the disastrous war with Prussia (see FRANCO-GERMAN WAR). Then followed the fall of the Empire, the flight of the empress from Paris, the death of Napoleon, and, as the crowning tragedy of Eugenie's life, the loss of her son, the Prince Imperial, who was slain in the Zulu War in 1879. Since 1870 Eugenie has resided mainly in England. See NAPOLEON III.

EULENSPIEGEL, *oi'len shpe'g'l,* TILL, a German wit, supposed to have lived in the first half of the fourteenth century, about whose name center numerous stories of wild, whimsical frolics and clownish pranks. These are all of an extremely coarse and brutal nature. An account of his antics was written in 1483 in Low Saxon and printed in High German thirty-six years later. This has been translated into Czech, Polish, Danish, French, Latin and English, the latter version appearing under the title *Howle-Glass.* The merry pranks of Till Eulenspiegel are the theme of a well-known orchestral symphony by Richard Strauss.

EUPHRATES, the largest river of Western Asia, conspicuous in the world's history for over twenty-five centuries. In early times it was important as a boundary. It was the eastern border of the Jewish kingdom; it separated Assyria from the Khita, or Hittites; it divided the eastern from the western satrapies of Persia, and at several periods was the boundary of the Roman Empire. Arabic geographers as late as A.D. 1200 mention a large number of important cities on its shores and islands. The middle Euphrates to-day flows past a mass of ruins. From an early period, antedating 3000 B.C., it was the highway of commerce between East and West, and numerous empires have left their records on its shores.

The length of the river, from its source at Diadin to the sea, is about 1,800 miles. The area of its basin is 260,000 square miles, or about as great as that of the state of Texas. Its course is mainly southeasterly through the great alluvial plains of Babylonia and Chaldea; it flows into the Persian Gulf by several mouths, of which only one in Persian territory is navigable. It is joined by the Tigris about 100 miles from its mouth, when the united streams take the name of Shat-el-Arab. In the Old Testament the Euphrates is called the Great River. For map, see ASIA.

EUREKA, *u re'ka,* CAL., the county seat of Humboldt County, on Humboldt Bay, on the northwest coast of the state, 225 miles northwest of San Francisco. An excellent natural harbor has been improved by the Federal government, and steamers sail regularly between this and other Pacific coast ports. Eureka is now connected with San Francisco by the Northwestern Pacific Railroad. In 1910 the population was 11,845; in 1916 it was estimated to be 14,684. The city is in the famous redwood region. It has a large trade in redwood lumber, shingles, apples, wool, butter and fish. The industries include wood-working mills, a woolen mill, an iron foundry, a tannery, tobacco factories and marble and granite works.

Settled in 1850, Eureka was incorporated and made the county seat in 1856. The more prominent buildings are a Federal building, courthouse, city hall, county jail and hospital. Near the city is Sequoia Park, a redwood forest forty acres in extent.

EUREKA SPRINGS, ARK., a city in the extreme northwestern part of the state near the Missouri border, famous for its group of fifty medicinal springs and for its healthful climate. It is one of the county seats of Carroll County (the other is Berryville) and had a residential population of 3,228 in 1910. This number is greatly increased throughout the year, however, by transients in pursuit of health and pleasure, for aside from its beneficial waters, the place is attractive for its delightful location 1,800 feet above sea level, in the midst of some of the most picturesque scenery of the Ozark Mountains. Joplin, Mo., is seventy-two miles northwest, and Springfield, Mo., is eighty-five miles northeast. The

city is served by the Missouri & North Arkansas Railroad, and is within a twelve-hour ride from Saint Louis, Kansas City, Dallas, Memphis or Little Rock.

Though the city is primarily a health resort, the agricultural resources of the vicinity offer inducements to the home-builder. A great variety of fruits and abundant supplies of alfalfa are grown in the vicinity; there is also excellent timber, and a fine grade of onyx is found. The city has several large hotels, a Carnegie Library, a high school and Crescent College for Girls.

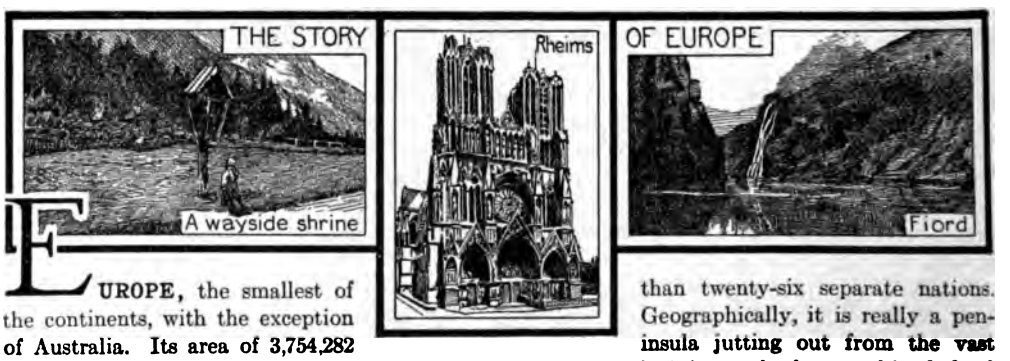
The first settlement was made in 1879 and named *Eureka,* a Greek word meaning *I have found it;* the following year the city was chartered. The springs are held in trust by the city and the waters are free to the public. The city is operated under the commission form of government. J.B.

EURIPIDES, *u rip'i deez* (about 480-406 B.C.), a poet of Greece, accorded by common consent the third place among the Greek masters of tragedy. He is said to have written a drama at the age of eighteen; but his first play was brought out when he was twenty-five. In 441 B.C., at the age of thirty-nine, he contended for the tragic prize, bringing out a series of four dramas, one of which was the *Medea.* The first prize was given to a son of Aeschylus, the second to Sophocles, and the third to Euripides. From this time Euripides and Sophocles were friendly competitors for dramatic honors.

In 408 B.C., at the age of seventy-two, Euripides brought out at Athens his tragedy of *Orestes.* Directly afterward he was invited by King Archelaus to go to the kingdom of Macedon, for the king was desirous that Greeks of culture should reside in his dominions. Here Euripides completed several of his dramas known to-day, but he died two years after he took up his residence in Macedon. By none was he mourned more than by the aged Sophocles, his great rival, who was then bringing out the last of his tragedies at Athens. Sophocles clothed himself in mourning and ordered the actors to present themselves in funeral attire. The Athenians set up a bust of Euripides in the public place, and Thucydides composed an inscription which was placed on a monument built in his honor.

The men whose names are foremost in Greek literature—Aeschylus, Sophocles, Socrates and Aristophanes—were contemporaries of Euripides. The poet had the misfortune to make an enemy of Aristophanes, whose sneers are still voiced by many critics. According to some authorities Euripides composed ninety-two tragedies. The following are the titles of the extant dramas, arranged in the order of their composition: *Alcestis; Medea; Hippolytus; Hecuba; Ion; Supplicants; Heracleidae; Mad Hercules; Troades; Electra; Helena; Phoenissae; Iphigenia in Tauris; Andromache; Orestes; Bacchae; Cyclops; Iphigenia at Aulis.* M.B.T.

EUROPA, *u ro'pa,* according to Greek legend, a daughter of Phoenix, king of Phoenicia, or of Agenor, and the sister of Cadmus. She was admired by Jupiter, who appeared in the form of a white bull, and carried her to Crete. The myth inspired several notable paintings, the most celebrated of which is that by Paul Veronese in the Ducal Palace, Venice. Another, by Titian, is at Cobham Hall, England. Contrary to belief sometimes expressed, the word *Europe* is not derived from this name. See explanation in article EUROPE.



EUROPE, the smallest of the continents, with the exception of Australia. Its area of 3,754,282 square miles is only about 25,000 square miles greater than that of Canada, but while Canada *is one country,* Europe consists of no fewer than twenty-six separate nations. Geographically, it is really a peninsula jutting out from the vast continent of Asia, and the combined land mass of the two continents is often spoken of as *Eurasia.* This peninsulalike character

EUROPE

AREA AND POPULATION

Political Divisions	Area Sq. Mi.	Population 1910	Population Per Sq. Mi.	Capital	Population 1910	Other Important Towns	Population 1910
Albania	11,317	*825,000	72.6	Durazzo †	*5,000	Skutari	*32,000
Austria-Hungary	261,259 ‡	51,109,471	195.6	Vienna	2,149,800	Prague	591,500
				Budapest	880,371		
Belgium	11,373	7,423,784	652.7	Brussels and suburbs	663,647	Antwerp	312,884
Bulgaria	43,310	4,752,997	109.7	Sofia	102,812	Philippolis	47,981
Denmark	15,592	2,757,076	176.7	Copenhagen	462,161	Aarhus	61,755
France	207,054	39,601,509	192.2	Paris	2,888,110	Marseille	550,619
Germany	208,780	*67,812,000	324.8	Berlin	2,071,257	Hamburg	931,035
Great Britain and Ireland (a)	121,633	45,370,530	373.0	London	7,251,358	Liverpool	746,421
Greece	41,933	*4,821,832	114.9	Athens	(b) 167,479	Saloniki	(c) 160,000
Italy	110,632	*36,120,118	326.4	Rome	*590,960	Naples	*697,917
Luxemburg	998	259,899	260.4	Luxemburg	20,848		
Montenegro	5,600	*516,000	92.1	Cetinjé	*5,500	Podgoritza	*14,000
Netherlands, The	12,648	*6,339,705	501.2	The Hague	312,430	Amsterdam	*609,084
Norway	124,642	2,392,698	19.2	Christiania	241,834	Bergen	76,867
Portugal	35,490	5,975,985	168.3	Lisbon	435,359	Oporto	194,009
Rumania	53,489	(d) 7,508,009	140.3	Bukharest (Bucharest)	*345,628	Jassy	*76,120
Russia §	1,867,737	*128,864,300	69.1	Petrograd	*2,133,100	Moscow	*1,817,100
Serbia	33,891	4,547,990	134.1	Belgrade	90,890	Monastir	59,850
Spain	194,783	*20,355,983	104.5	Madrid	599,807	Barcelona	587,411
Sweden	172,963	*5,679,607	32.8	Stockholm	*386,270	Goteborg	*181,500
Switzerland	15,976	*3,877,210	242.6	Bern	*94,700	Zürich	*205,000
Turkey	10,882	*1,891,000	173.7	Constantinople	*1,000,000	Adrianople	*83,000

* Recent official estimate.

† Provisional capital. ‡ Including Bosnia and Herzegovina. § Figures are for European Russia. (a) The divisions composing the United Kingdom are: England, 50,874 sq. m.; Wales, 7,466 sq. m.; Scotland, 30,405 sq. m.; Ireland, 32,586 sq. m. Isle of Man, 227 sq. m.; Channel Islands, 75 sq. m. (b) Census of 1907. (c) Provisional census of 1913. (d) Census of 1912.

PRINCIPAL RIVERS

Name	Outlet	Length Miles	Drainage Sq. Mi.	Name	Outlet	Length Miles	Drainage Sq. Mi.
Danube	Black Sea	1,644	315,435	Memel (Niemen)	Kurisches Haff	437	34,965
Dnieper	Black Sea	1,064	203,460	Oka	Volga River	706	93,205
Dniester	Black Sea	646	29,675	Petchora	Arctic Ocean	915	127,225
Don	Sea of Azof	980	166,125	Po	Adriatic Sea	354	28,920
Donets (Donetz)	Don River	487	37,890	Rhine	North Sea	709	63,265
Douro	Atlantic Ocean	485	36,705	Rhone	Gulf of Lion	447	38,180
Drave	Danube River	434	15,745	Save	Danube River	535	37,595
Düna (Dwina)	Gulf of Riga	470	32,975	Seine	English Channel	425	30,030
Ebro	Mediterranean Sea	475	38,580	Tagus	Atlantic Ocean	566	31,865
Elbe	North Sea	612	55,340	Theiss (Tisza)	Danube River	550	59,350
Kama	Volga River	984	202,615	Ural	Caspian Sea	1,446	96,350
Loire	Bay of Biscay	543	46,755	Vistula	Baltic Sea	596	73,905
Meuse	Waal River	530	12,740	Volga	Caspian Sea	1,977	563,300
Mezen	White Sea	496	30,410	Vyatka	Kama River	596	50,555

PRINCIPAL LAKES

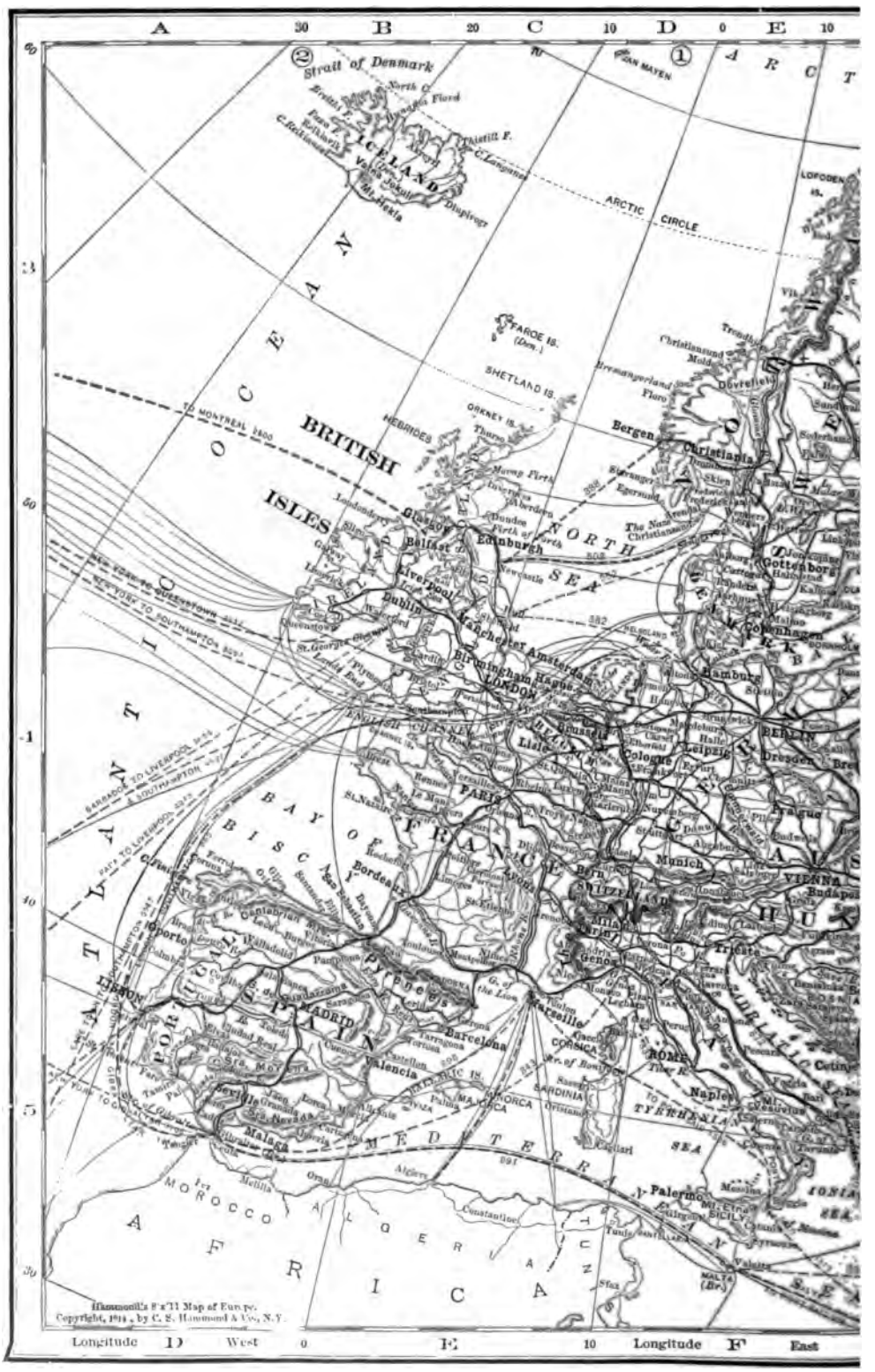
Name and Location	Area Sq. Mi.	Depth† Feet	Name and Location	Area Sq. Mi.	Depth† Feet	Name and Location	Area Sq. Mi.	Depth† Feet
Balaton, Hungary	266	13	Geneva, France, Switzerland	225	1,015	Neagh, Ireland	153	113
Como, Italy	56	1,360	Ilmen, Russia	358		Neuchâtel, Switzerland	85	500
Constance, Germany, Switzerland	208	825	Ladoga, Russia	7,004	703	Onega, Russia	3,765	1,200
Enare, Russia	549		Maggiore, Italy, Switzerland	82	1,220	Ulea, Russia	380	60
Garda, Italy, Austria	143	1,135	Mjösen, Norway	152	1,485	Vener, Sweden	2,149	280
						Vetter, Sweden	733	415

† Greatest depth.

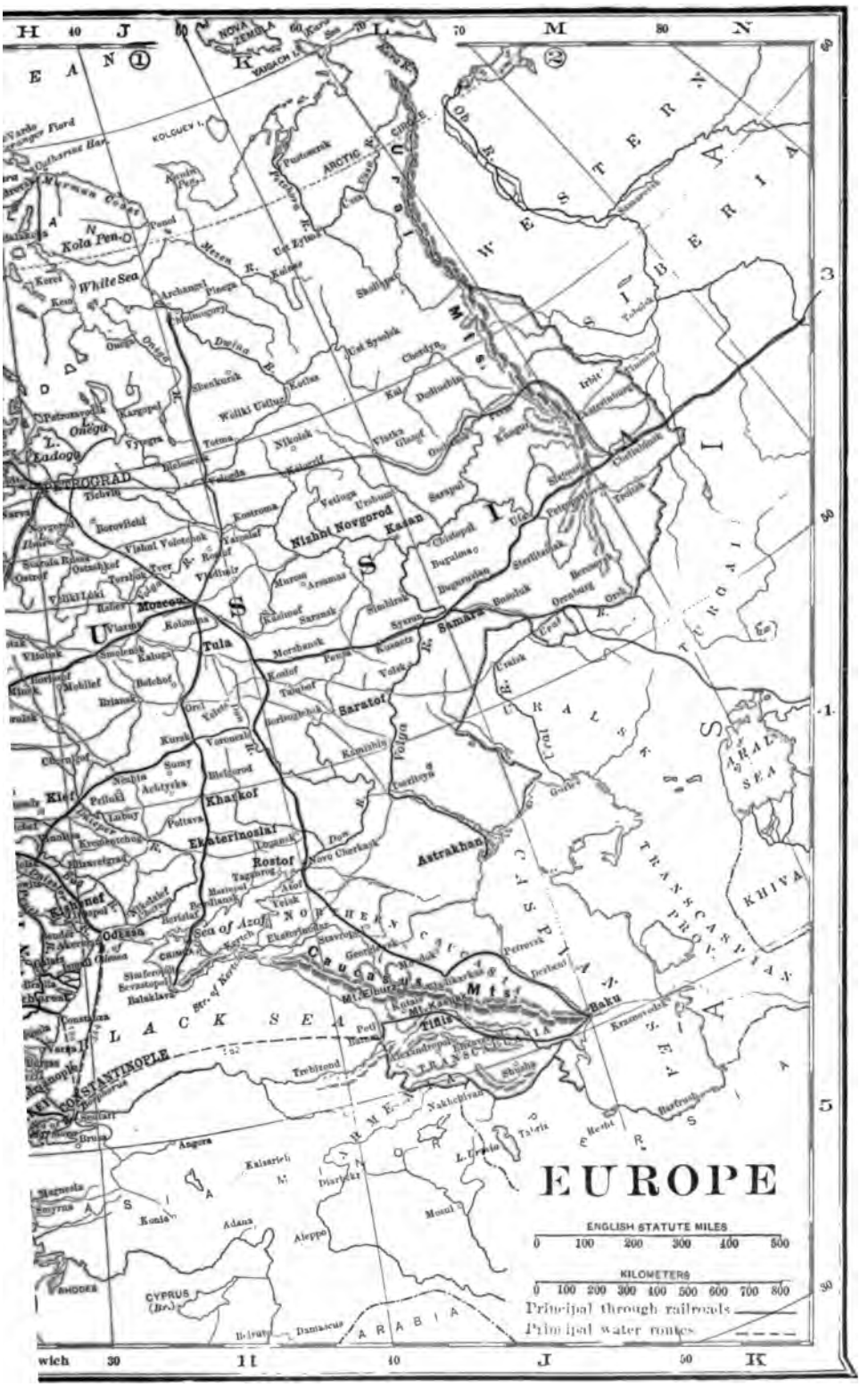
PRINCIPAL MOUNTAINS

Systems and Highest Summits	Elevation Feet	Systems and Highest Summits	Elevation Feet	Systems and Highest Summits	Elevation Feet*
Alps		*Alps, continued*		Scattered Highlands	
(1) *Western Division*		(2) *Central Division*		Apennines	9,560
Dent Blanche	14,385	Aletschorn	13,721	Auvergne	6,186
Dom (Mischabelhörner)	14,942	Finsteraarhorn	14,026	Balkan	7,786
Lyskamm	14,889	Gross Fiescherhorn	13,285	Carpathian	8,737
Matterhorn	14,782	Gross Schreckhorn	13,386	Despoto Dagh	10,000
Mont Blanc	15,782	Jungfrau	13,669	Etna	10,755
Monte Rosa	15,272	Mönch	13,468	Pyrenees	11,168
Mont Maudit	14,669	Piz Bernina	13,304	Sierra Nevada	11,420
Nord End (Monte Rosa)	15,132	(3) *Eastern Division*		Scottish Highlands	4,406
Pointe des Écrins	13,462	Gross Glockner	12,461	Scandinavian Alps	8,399
Täschorn	14,758	Gross Venediger	12,008	Ural Mountains	5,355
Weisshorn	14,804	Ortler	12,802		

* Highest point in range



Strait of Denmark
ICELAND
Mt. Hekla
ARCTIC CIRCLE
FAROE IS. (Den.)
SHETLAND IS.
ORKNEY IS.
HEBRIDES
BRITISH ISLES
NORTH SEA
Bergen
Christiania
Gottenborg
Copenhagen
Hamburg
BERLIN
Dresden
Prague
VIENNA
Budapest
Munich
Leipzig
Cologne
Brussels
Lisle
PARIS
Bordeaux
Lyons
Bern
SWITZERLAND
Milan
Genoa
Trieste
ROME
Naples
Palermo
SICILY
Marseille
CORSICA
SARDINIA
Barcelona
Valencia
MADRID
Pyrenees
Oporto
LISBON
Sevilla
Malaga
MEDITERRANEAN SEA
TYRRHENIAN SEA
MOROCCO
ALGERIA
AFRICA
Hammond's 8 x 11 Map of Europe.
Copyright, 1914, by C. S. Hammond & Co., N.Y.
Longitude D West
Longitude F East


EUROPE
ENGLISH STATUTE MILES
0 100 200 300 400 500
KILOMETERS
0 100 200 300 400 500 600 700 800
Principal through railroads
Principal water routes
H 40 J 50 K 60 L 70 M 80 N
Greenwich 30 I 40 J 50 K
NOVA ZEMLA
Kara Sea
Ob R.
WESTERN SIBERIA
Kola Pen.
White Sea
Archangel
Onega
L. Ladoga
PETROGRAD
Moscow
Nizhni Novgorod
Kazan
Samara
Tula
Saratov
Astrakhan
Kiev
Kharkof
Ekaterinoslaf
Rostof
Sea of Azof
Odessa
BLACK SEA
CONSTANTINOPLE
Caucasus Mts
Baku
Tiflis
Trebizond
Angora
Konia
Adana
Aleppo
Mosul
Damascus
CYPRUS (Br.)
RHODES
ARABIA
CASPIAN SEA
KHIVA
TRANSCASPIAN
URAL Mts
Volga R.
Ural R.

EUROPE BY CENTURIES FROM THE DISCOVERY OF AMERICA

	GREAT BRITAIN	GERMANY	FRANCE	OTHER COUNTRIES
1492	92 Henry VII invades France	93 Maximilian I Emperor	99 Conquest of Milan	92 Discovery of America by Columbus
1500	09 Henry VIII, king	12 Empire divided into 10 circles	5 Francis I invades Italy	03 Naples annexed to Spanish crown]
	12 War with France	17 Luther's Ninety-five Theses	21 Wars with Charles V	10 Tartar invasions of Russia
	13 Battle of Flodden Field	19 Charles V King of Spain	32 Struggle for possession of Italy	19 Cortez conquers Mexico
	43 Invasion of France	21 Diet of Worms	47 Henry II and Catherine de Medici	32 Union of Norway & Denmark
	47 Protestantism formally established	29 Turks invade Germany	62 Religious liberty granted Huguenots	33 Ivan the Terrible, Czar of Russia
	53 "Bloody Mary" Queen of England	43 Alliance with England against France	72 Massacre of St. Bartholomew	60 War between Sweden and Denmark
	58 Elizabeth ascends throne	51 Treaty of Passau	76 Catholic League	78 Alliance of Sweden & Poland against Russia
	64 Church of England established	56 Charles V abdicates	77 Sixth Religious War	79 Dutch Republic independent
	85 War with Spain	94 Union of Protestants at Heilbronn	88 Revolt of Paris	80 Portugal under Spanish dominion
1600	03 Union of England and Scotland	16 Beginning of Thirty Years War	14 Last assembly of states-general	10 Expulsion of Moors
	07 English settlement at Jamestown	20 Massacre of Prague	24 Cardinal Richelieu in power	11 Gustavus Adolphus, King of Sweden
	20 Pilgrims sail in Mayflower	29 Gustavus Adolphus lands in Germany	27 War with England	13 Founding of House of Romanoff in Russia
	27 War with France	40 Frederick Wilhelm the Great Elector	38 Invasion of Spain	39 Naval victory of Holland over Spain
	42 Civil War and Revolution	48 Peace of Westphalia	40 French take Turin	45 Peace between Denmark and Sweden
	49 Commonwealth under Cromwell	65 Tyrol united to Austria	49 Siege of Paris	46 Revolt of Naples
	52 War with Holland	73 War of Austria and France	59 Peace of the Pyrenees	54 Spain recovers Portugal from Dutch
	60 Stuarts restored under Charles II	76 General revolt of Hungarians	67 War with Spain	57 Ottoman-Swedish alliance against Poland
	68 Alliance of England, Sweden and Holland against France	80 Part of Alsace seized by France	72 War with Holland 78 Peace with Holland and Spain	71 Cossacks subjugated 74 Sobieski, King of Poland
	85 James II, king	83 Siege of Vienna by Turks	85 Revocation of the Edict of Nantes	78 First War of Russia with Ottoman Empire
	89 War with France	87 Joseph I, King of Hungary	88 War of allies against France	89 Peter the Great rules Russia
	97 General peace	90 Joseph I elected King of the Romans	97 Peace of Ryswick	99 Ottoman power broken
1700	02 Queen Anne's War	01 Hague Alliance	02 Invasion of Holland	00 Wars of Peter the Great
	04 England takes Gibraltar	04 Battle of Blenheim	18 Quadruple Alliance against Spain	02 Chas. XII sweeps Poland and Russia
	07 Act of Union of Eng. and Scotland	18 Quadruple Alliance against Spain	33 War of Polish Succession	07 France and Spain driven out of Italy
	13 Treaty of Utrecht	33 War of Polish Succession	40 War of Austrian Succession	14 Russia conquers Finland
	18 War with Spain	40 War of Austrian Succession	44 War with England and Austria	17 Turks lose Belgrade
	62 War with Spain	45 Francis I and Maria Theresa rule	47 War with Holland	20 Peace of Stockholm
	63 Peace of Paris	56 Seven Years War	60 Loss of Canada	23 Christians expelled from China
	75 War with American colonies	72 Partition of Poland	78 Alliance with America	65 Establishment of England's rule in India
	81 Surrender of Cornwallis	78 Bavaria seized	89 Beginning of French Revolution	74 Revolt of Cossacks in Russia
	83 Independence of U. S. acknowledged	92 War with France	92 France declared a Republic	96 Napoleon's Italian campaign
	97 Nelson destroys French fleet	93 First coalition against France	93 Reign of Terror	97 Swiss revolution
	98 Second coalition against France	97 Napoleon's Austrian campaign	95 Rise of Napoleon Bonaparte	98 Roman republic proclaimed
1800	00 Union of England and Ireland	04 Confederation of the Rhine	04 Napoleon made Emperor	03 Napoleon crowned King of Italy
	03 Successful war in India	13 War of German Independence	05 Battle of Austerlitz	05 Russia joins coalition against France
	12 War with U. S.	15 German League —Congress of Vienna	14 House of Bourbon restored	06 Louis Napoleon, King of Holland
	15 Wellington's victory at Waterloo	62 Bismarck made premier	15 Napoleon returns from Elba Defeat of Napoleon at Waterloo	14 Union of Sweden and Norway. 15 Netherlands united under William I
	48 Civil war in Ireland	66 First Parliament of German Confederation		
	50 Punjab annexed to British crown	67 North German constitution accepted	30 The July Revolution	30 Belgium becomes independent
	53 End of Kaffir War	71 King of Prussia proclaimed Emperor of Germany	36 Insurrection attempted by Louis Napoleon	32 Kingdom of Greece founded 48 Rebellion in Hungary
	54 Crimean War	72 Expulsion of Jesuits	52 Louis Napoleon declared emperor	60 War against China by England and France
	60 Rebellion in India subdued	88 Accession of William II	60 Commercial treaty with England	61 Victor Emmanuel II, first King of Italy
	76 Queen Victoria Empress of India	91 Triple Alliance renewed	70 War with Prussia	78 Congress of Berlin
	99 Boer War in South Africa	95 North Sea and Baltic Canal opened	71 Capitulation of Paris—peace restored	96 Russia leases Port Arthur from China
1900	02 End of Boer War	06 Propaganda against Socialism	01 Diplomatic relations with Turkey severed	00 Boxer Rebellion in China
	04 Trade Treaty With Thibet	11 Franco-German agreement over Morocco	05 Moroccan troubles increased	04 Russo-Japan War
	08 Great Britain, France & Russia combine to prevent war over Balkans	12 Socialists make remarkable gains; Defense bill; increase in navy and army; Triple Alliance renewed	07 French occupy Morocco	06 Norway and Sweden independent kingdoms
	09 House of Commons passes Irish Land bill	14 Ultimatum to Russia	11 Labor riots	10 Portugal a Republic Montenegro made a kingdom
	14 War declared on Germany	14 War declared on Russia and France	12 Protectorate over Morocco 14 Declares war on Austria and Germany	12 China becomes a republic

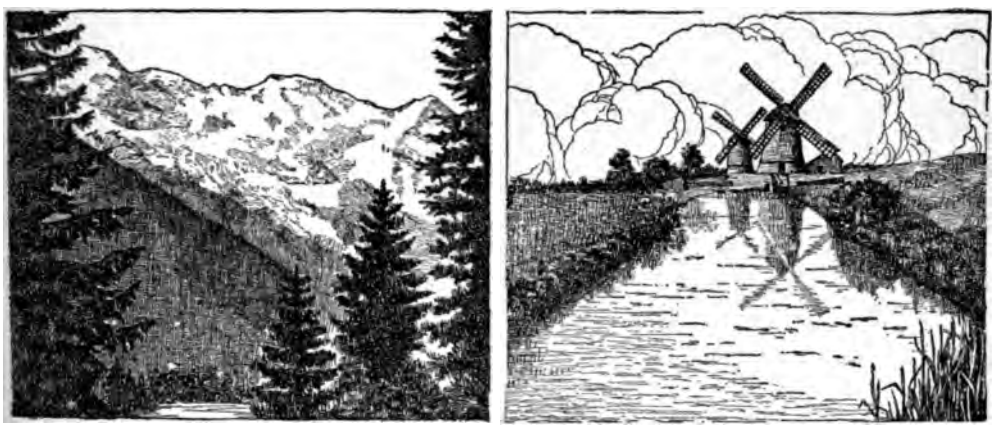
is strikingly evident from the fact that save for Russia and the very easternmost portions of Austria-Hungary, no point in Europe is more than four hundred miles from the sea. Closely as the two continents are connected, however, there has always been a recognized distinction, and dwellers in Asia Minor thousands of years ago gave to the lands across the Aegean the name *Ereb,* or "land of the setting sun," just as they called their own land *Assu,* or "land of the rising sun." Gradually the former name was corrupted into its present form, and was at the same time extended in its significance to cover the whole western continent.

Why Europe is Important. Even if Europe is geographically but a pendant of Asia, it has been the world's most important continent, so far as the history of civilization is concerned. Not without full reason did Tennyson exclaim—

> Better fifty years of Europe than a cycle of Cathay.

True, the very earliest civilizations grew up in Asia and Africa, but these waned centuries before the beginning of the Christian Era, while Europe gradually became the home of most of the important nations of the world. Progress has been almost unknown among other than European peoples. There are in the Americas federations which have made wonderful advance, but these were all founded —and not a great while ago, as history reckons time—by Europeans. The states of Africa which count in the world's affairs are controlled by Europeans, while the two great countries of the East (China and Japan) awakened from their centuries-long sleep only when the nations of Europe and the American republic, founded by Europeans, knocked at their doors. Practically all of the great books and pictures, the music and the sculpture, as well as the inventions and the so-called "comforts of life," have been produced by Europeans or by their descendants.

The People. No other continent is as densely populated as Europe. Asia, it is true, has twice as many inhabitants, but it is so much larger that its density percentage is less than half that of Europe. In the latter continent, with its 480,000,000 people, there is an average of over 125 people to the square mile. They are very unevenly distributed, for the barren northern parts of Sweden and Russia, with their long, bitter winters, are almost unpopulated, while in portions of the fertile north-central plain the people are crowded together until it seems a marvel that they can find means of supporting themselves. Of all the countries Belgium, with 653 people to the square mile, is the most densely populated, while Sweden, with but thirty-two, has fewest people to each square mile. That is, the least densely populated country of Europe has more inhabitants to the square mile than has the United States as a whole, which has but thirty-one.



GREATEST EXTREMES IN ALTITUDE IN WESTERN EUROPE

Mont Blanc rears its summit 15,782 feet above sea level; the low country of Holland is below sea level, and the Dutch dykes have played an important part in the history of the Netherlands.

What is a European? There is no such thing as a European in the sense in which there is an African, for instance; in other words, there is no European race. The ancient Greeks, the earliest civilized inhabitants of the continent, boasted that they sprang from the soil, and that their ancestors had

never migrated from any other land. But it is certain that at some far-distant period the ancestors of the present Europeans did cross into that continent, most of them from Asia, and a few, in all probability, from Africa. Wherever they may have come from originally, ninety-five per cent of them are of the Caucasian, or white, race. Among them, however, there are very pronounced differences, both in appearance and in character. The Norwegians, with their stalwart frames, fair hair and ruddy skin, differ more in appearance from the small, dark-skinned people of Southern Italy than the latter do from certain members of the brown race, while it is difficult to believe that the comparatively unemotional Swedes can belong to the same race as the emotional French.

Customs differ widely, too, and almost every one of the twenty-six countries has its own peculiar dress, to which the peasants have clung long after the upper classes have adopted more cosmopolitan standards. Students of anthropology lay much stress on the shape of the head as an indication of race relationship, and point out that there are two distinct shapes among Europeans—the long head and the broad head; and it is interesting to note that these two types have persisted through the centuries, despite all the intermingling.

The term *Mongolian* compels instant thought of the Chinese and Japanese, but does not suggest any European peoples, yet there are over 20,000,000 of the Mongol race in Europe —all of that five per cent who are not Caucasians. They include the Magyars, or Hungarians, the Finns, the Turks and the Bulgarians, who are characterized by the straight, dark hair, yellowish skin and broad cheek bones which are typical of the race.

Language. About sixty different languages are spoken by the nations which inhabit Europe to-day. Some of these languages, like German, English and French, are the mother-tongues of millions of people; others, like Icelandic and Basque, are spoken only by a few thousands. Most of these languages are broken up into a number of dialects, some of which are understood only with great difficulty even by people who speak the same tongue. According to their origin the European languages belong to three great branches —the Teutonic, the Slavonic and the Romanic, or Neo-Latin—which are all members of one great group, known as the Indo-European group. *Hungarian*, Turkish and Finnish are the only principal languages that belong to another group, the Turanian.

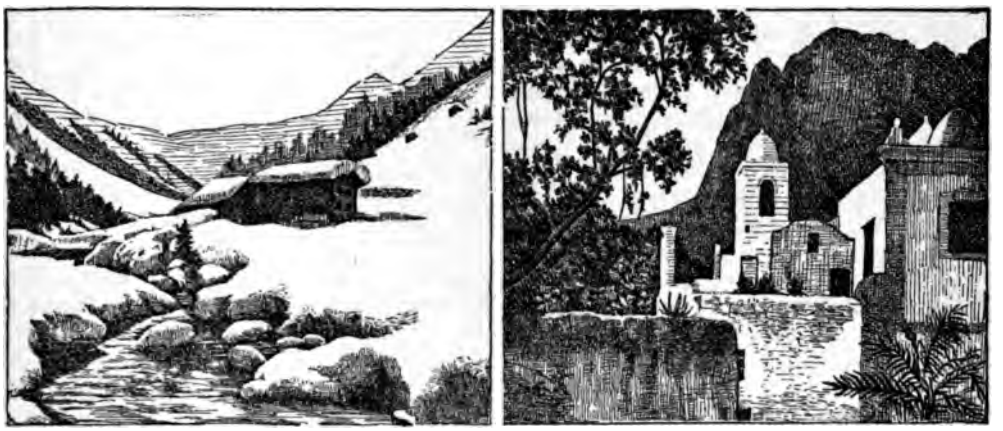
The following list contains the principal languages spoken in each country of Europe:

Albania:	Albanian.
Austria:	German, Bohemian (in Bohemia), Polish (in Galicia), Ruthenian (in Galicia and Bukovina), Croatian (in Carniola and Bosnia), Serbian (in Dalmatia and Herzegovina), Rumanian (in Bukovina), Italian (in Trentino and Trieste) and Ladin (in Trentino).
Belgium:	French, Flemish, Walloon.
Bulgaria:	Bulgarian, Turkish, Armenian, Gypsy dialects.
Denmark:	Danish, Icelandic (in Iceland).
France:	French, Provençal (in the south), Basque (on the slopes of the Pyrenees), Low Breton (in Brittany, northwest of France).
German Empire:	German, Polish (in Eastern Prussia), French (in Alsace-Lorraine).
Greece:	Greek, Bulgarian, Albanian, Rumanian, Turkish.
Hungary	Hungarian, Croatian (in Croatia-Slavonia), Serbian (in the Banat), Slovenian (in Croatia-Slavonia), Slovakish (along the western slopes of the Carpathians), Rumanian (in Transylvania) and Gypsy dialects.
Italy:	Italian.
Montenegro:	Montenegrin.
Netherlands:	Dutch, Flemish.
Norway:	Norwegian.
Portugal:	Portuguese.
Rumania:	Rumanian, Bulgarian, Armenian, Gypsy dialects.
Russia:	Russian, Ruthenian or Little Russian, Bielo-Russian or White Russian, Polish, Lithuanian, Lettish, Finnish, Esthonian, Livonian, Tatar, Turkish, Kalmuk, Lappish, Rumanian.
Serbia:	Serbian, Albanian.
Spain:	Spanish, Basque (on the slopes of the Pyrenees).
Switzerland:	German, Italian, French, Ladin.
Turkey:	Turkish, Greek, Bulgarian.
United Kingdom:	English, Welsh (in Wales), Gaelic (in Scotland), Irish, Manx (in Isle of Man).

Religion. Christianity did not originate in Europe, but dates there from Paul's vision of the man who pleaded, "Come over into Macedonia and help us"; however, that continent has been the great stronghold of the faith, and to-day about ninety-five per cent of Europeans are Christians. The three great branches of

the Christian Church are the Protestant, the Orthodox, or Greek, and the Roman Catholic, the last having by far the greatest number of adherents. The remaining five per cent of the people are for the most part Mohammedans or Jews.

Some Interesting Measurements. The northernmost point of the mainland of Europe is North Cape, far up in the polar ice in latitude 71° 11′ north; its southernmost limit is Cape Tarifa, in Spain, at 36° north. In its east and west direction it extends from Cape de Roca in Portugal, 9° 27′ west, to a spot in the Ural Mountains of Russia at 66° 21′ east. Its greatest dimension east and west is 3,293 miles; its greatest length from north to south, about 2,400 miles. The coast line of Europe is of peculiar interest, for it is much longer in proportion to area than that of any other continent. The usual method of reckoning, which takes account only of the larger inlets, gives its total length as about 20,000 miles, while another, which includes the small gulfs and bays and river mouths, makes it almost 48,000 miles. In its altitude Europe has no such extremes as has Asia or even North America, for its loftiest mountain peak, the famous Mont Blanc (which see), is but 15,782 feet in height, while its deepest depression, the Caspian Sea, is but eighty-six feet below the level of the sea.



EXTREMES OF CLIMATE

When the condition exists in Norway which is shown at the left, sunny Italy enjoys almost a tropical clime.

Main Physical Features. The details of the surface formation of Europe are given in articles treating the separate countries; here it is necessary to consider only such features as exercise a real influence on the climate, the industries or the history of the continent. Of the utmost importance are its coast waters, which include the Arctic Ocean, the White Sea, the Caspian Sea, the Black Sea, the Sea of Azov, the Bosporus, the Sea of Marmora, the Dardanelles, the Aegean, the Mediterranean and the Adriatic seas, Strait of Gibraltar, the Atlantic Ocean, Bay of Biscay, English Channel, North Sea, Gulf of Bothnia and Baltic Sea. The detailed history of Europe could not be written without a consideration of most of these, nor could the economic progress of its many peoples be understood, for only these numerous coast waters could have made it possible for many nations to develop in this comparatively small area. Islands, too, are numerous, and have played a very important part, the British Isles, especially, ranking as one of the main divisions of the continent.

Highlands and Lowlands. A relief map of Europe shows a certain resemblance to that of North America, in that there are two highland or mountain regions, with a lowland region between. In America the trend of these is north and south; in Europe it is east and west. The great highland region of Europe is in the south and extends across the continent from the coast of Portugal to the Black Sea, while spurs of it jut southward into the various peninsulas. The islands off the southern coast are mere outcroppings of partially submerged mountain ranges, separated from the mainland by shallow seas. This Mediterranean highland district is about 800,000 square miles in area, and includes the Balkans, the Apennines, the Pyrenees and, as its dominating height, the Alps. The influence of geography on history

is strikingly evidenced in this region. There are no great plains where large nations might develop, but in every valley or small plain a little state grew up, quite distinct in most instances from the next little state just over the mountains. Especially in the histories of Greece and Italy was this tendency apparent. Only in very modern times, when mountains were no longer effective barriers, was the old tendency towards isolation overruled, and thus engineers deserve their share of credit, along with the patriots, in the formation of a united Italy.

The other highland region, in the northwest, is less extensive, but includes much of Finland, Norway and Sweden, Scotland and Ireland. The actual mountain region is very unproductive, because the best soil was carried away ages ago by the glaciers, but the sea is close at hand and fishing is profitable enough to make up for the lack of agricultural possibilities.

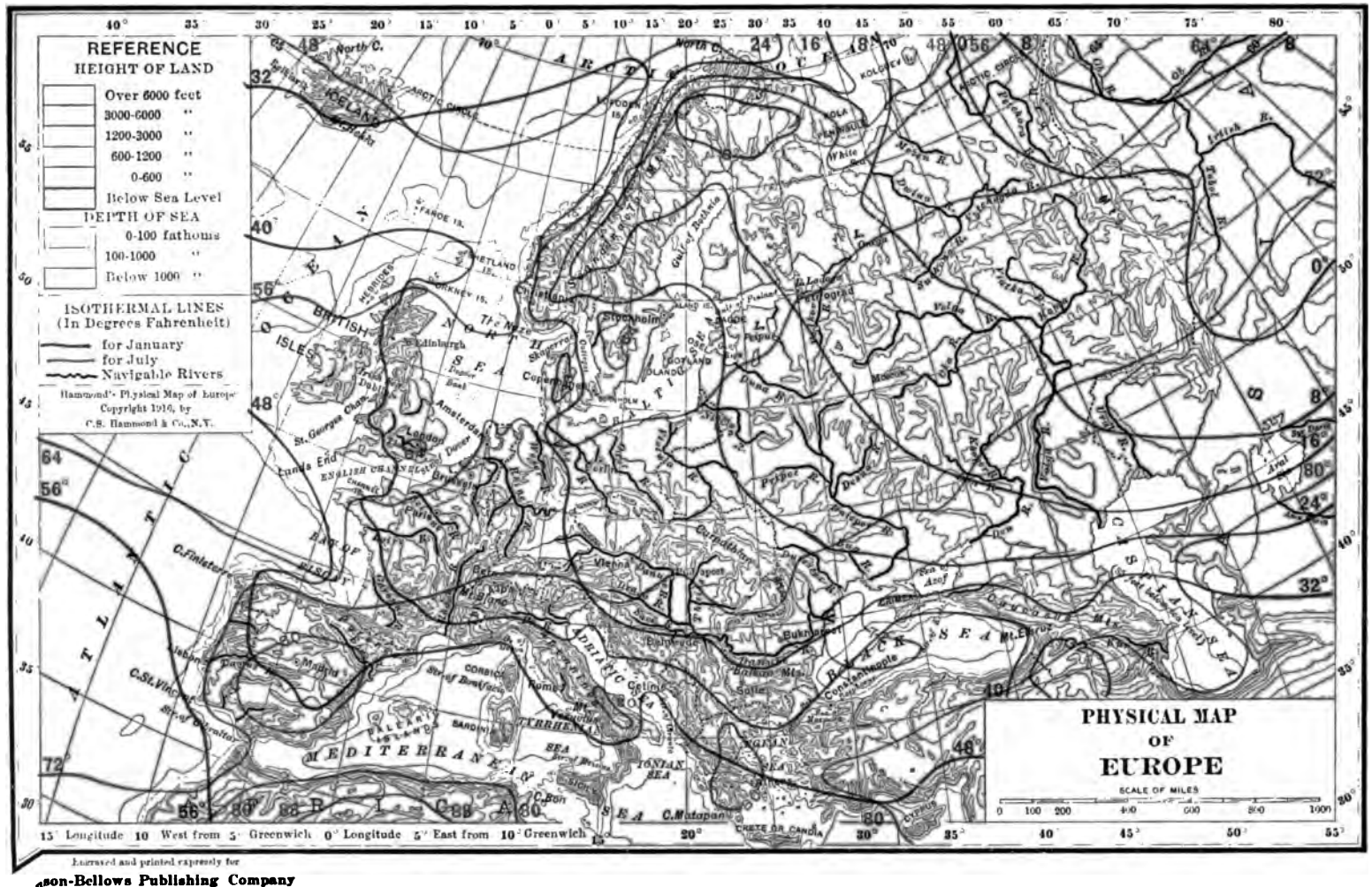
The most important part of Europe, however, is the great lowland province, extending from the Atlantic to the eastern boundary of the continent. Most of Russia, Austria-Hungary, Germany, Denmark, Holland, Belgium, France and England lie in it, so that it is without doubt one of the most important plains in all the world. In most places the soil is fertile, and this, together with its navigable rivers and the absence of high mountains which prohibit easy intercourse, accounts in large measure for the wonderful development of the nations which make their homes upon it.

Watèrs. There is no well-marked Great Divide in Europe, but the main watershed has a winding direction from southwest to northeast (see DIVIDE). From the Alps descend the Rhine, the Rhone and the Po, while the Danube, greater than any of these, rises in the Black Forest, north of the Alps. The longest river of Europe is the Volga (which see), which after a course of almost 2,400 miles empties into the Caspian Sea. Other rivers are the Meuse, the Scheldt, the Loire, the Marne, the Seine, the Elbe, the Main, the Vistula, the Diester and the Don, and these, with many more, are given separate treatment in these volumes. Of lakes the continent has many. There are, most famous of all, the wonderfully beautiful lakes of the Alpine re- those of the celebrated Lake Region of ; the Scandinavian basins; and the of European fresh-water bodies, lakes nd Ladoga in Russia. Between Europe and Asia lies the greatest salt-water lake in the world—the Caspian Sea.

Climate and Vegetation. No other continent lies so largely within the temperate zone as does Europe. It is crossed in the extreme north by the Arctic Circle, but it alone of all the continents nowhere extends into the torrid zone. Owing to the closeness of most parts of the continent to the sea, the climate is remarkably mild and genial, considering the latitude. Russia, however, is removed from the equalizing influence of the sea breezes, and has what is known as a "continental climate," with extremes of heat and cold. The southern peninsulas, cut off by the mountains from the northern winds and open to the influences of the Mediterranean, have a climate far more mild and uniform than that of corresponding latitudes in North America. Naples, for instance, is in about the same latitude as Pittsburgh, but has an almost subtropical climate, while the American city is subject to bitter winter temperatures and sweeping blizzards. See CLIMATE, and the map in the article RIVIERA.

Europe has no desert areas, and almost everywhere there is enough rainfall for agriculture, though in Russia, near the shores of the Caspian Sea, there is a very dry stretch. In some places, as in Spain, irrigation is necessary, for while there is plenty of rain, it falls after the growing season and is of no use for crops.

Vegetation. Because of the generally mild climate and plentiful rainfall, there is vegetation everywhere in Europe. In the near-desert region of Russia, referred to above, only grass will grow, while in the Arctic region the peculiar tundra conditions prevail (see TUNDRA), but almost everywhere else trees and flowering plants are abundant. Farthest north is the zone of the cone-bearers, the pines, firs and spruces, and next come the oak and the beech woods. Well down through the Middle Ages the north-central plains of Europe were but a great forest, in the clearings of which settlements had sprung up. In the southern part of the continent the olive is characteristic, but almost any tree will grow which has thick, leathery leaves that allow but slow evaporation of the tree's moisture. The details of the agricultural production of Europe are given in the articles on the various countries, but it is interesting, and to a dweller in North America astonishing, to learn that Europe, in normal times, produces more wheat, more oats,



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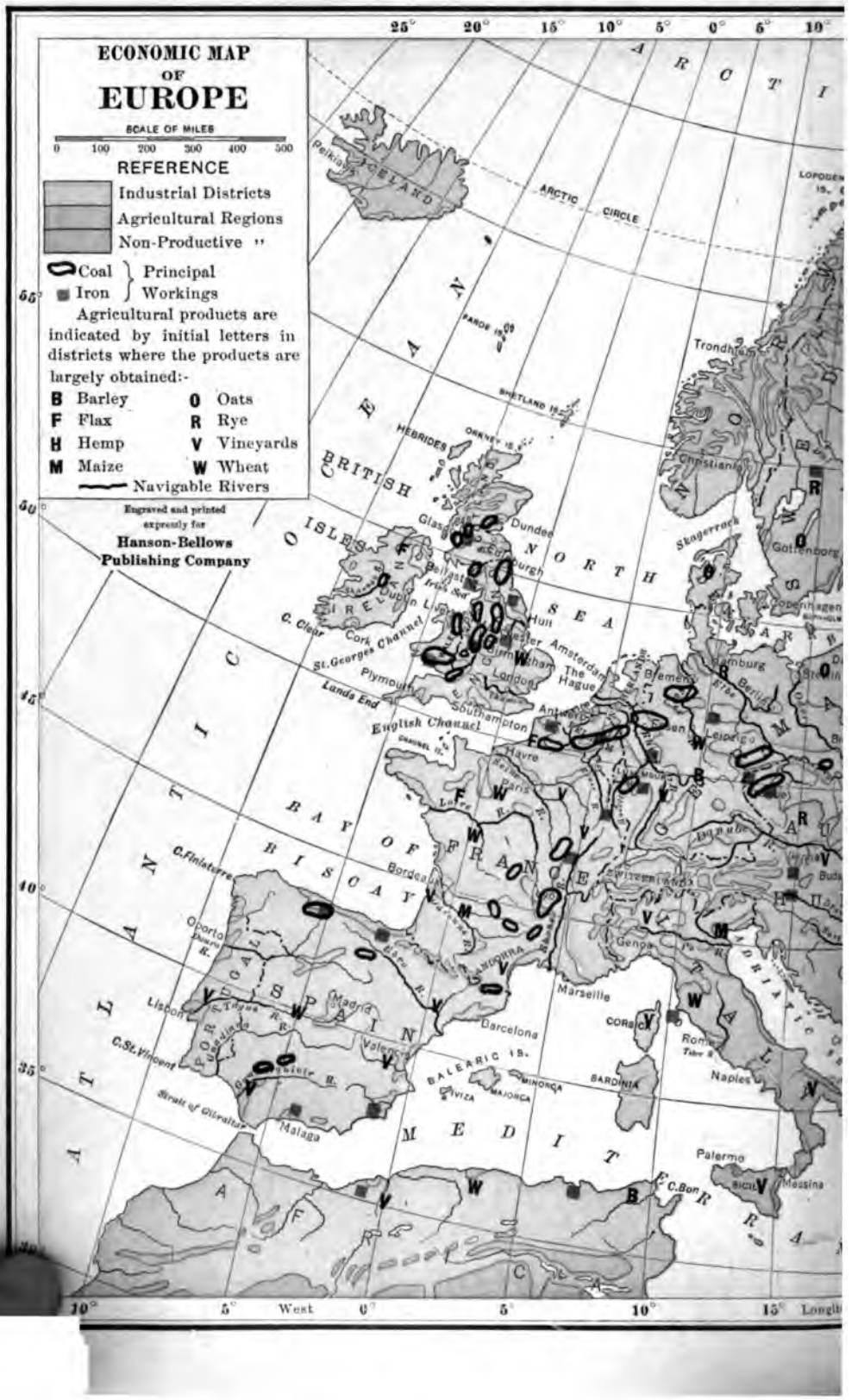
ECONOMIC MAP
OF
EUROPE
SCALE OF MILES
0 100 200 300 400 500
REFERENCE
Industrial Districts
Agricultural Regions
Non-Productive "
Coal
Iron
Principal Workings
Agricultural products are indicated by initial letters in districts where the products are largely obtained:-
B Barley
F Flax
H Hemp
M Maize
O Oats
R Rye
V Vineyards
W Wheat
Navigable Rivers
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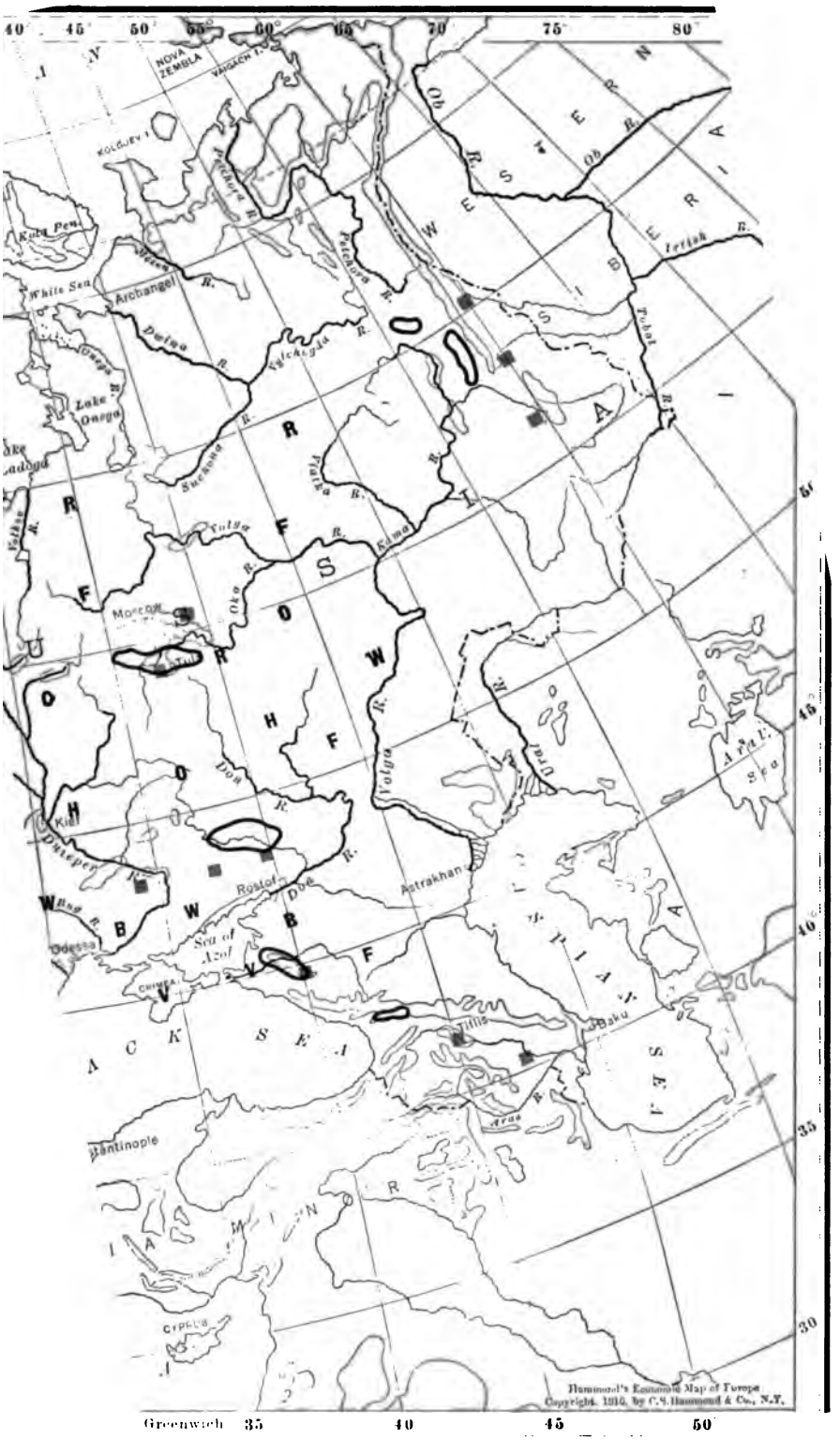
ARCTIC CIRCLE
ICELAND
FAROE IS.
SHETLAND IS.
ORKNEY IS.
HEBRIDES
BRITISH ISLES
NORTH SEA
ATLANTIC
BAY OF BISCAY
ENGLISH CHANNEL
MEDITERRANEAN
BALEARIC IS.
MINORCA
MAJORCA
IVIZA
SARDINIA
CORSICA
SICILY
Trondhjem
Christiania
Gothenburg
Copenhagen
Dundee
Glasgow
Edinburgh
Belfast
Dublin
Cork
Hull
Amsterdam
The Hague
London
Plymouth
Southampton
Antwerp
Hamburg
Bremen
Berlin
Leipzig
Havre
Paris
Bordeaux
Oporto
Lisbon
Madrid
Valencia
Barcelona
Marseille
Genoa
Rome
Naples
Palermo
Messina
Malaga
Gibraltar
C. Finisterre
C. St. Vincent
C. Clear
Lands End
C. Bon
Strait of Gibraltar
25° 20° 15° 10° 5° 0° 5° 10°
65° 60° 55° 50° 45° 40° 35° 30°
10° 5° West 0° 5° 10° 15° East



NOVA ZEMBLA
VAIGACH I.
KOLGUEV I.
Kola Pen.
White Sea
Archangel
Dwina R.
Onega R.
Lake Onega
Lake Ladoga
Petchora R.
Vyichegda R.
Suchona R.
Volga R.
Kama R.
Oka R.
Moscow
Tula
Don R.
Kiel
Dnieper R.
Bug R.
Odessa
Rostof
Sea of Azof
CRIMEA
Astrakhan
Volga R.
Ural R.
Ob R.
Irtish R.
Tobol R.
Tiflis
Baku
Aras R.
Aral Sea
Constantinople
CYPRUS
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Greenwich

VEGETATION MAP
OF
EUROPE
SCALE OF MILES
0 100 200 300 400 500
REFERENCE
Natural Vegetation
Ice Desert, Tundra and Alpine Flora
Coniferous Forest
Broad-leaved Forest and Meadow
Evergreen Trees and Shrubs
Temperate Grasslands
Semi-desert
Desert
Oases
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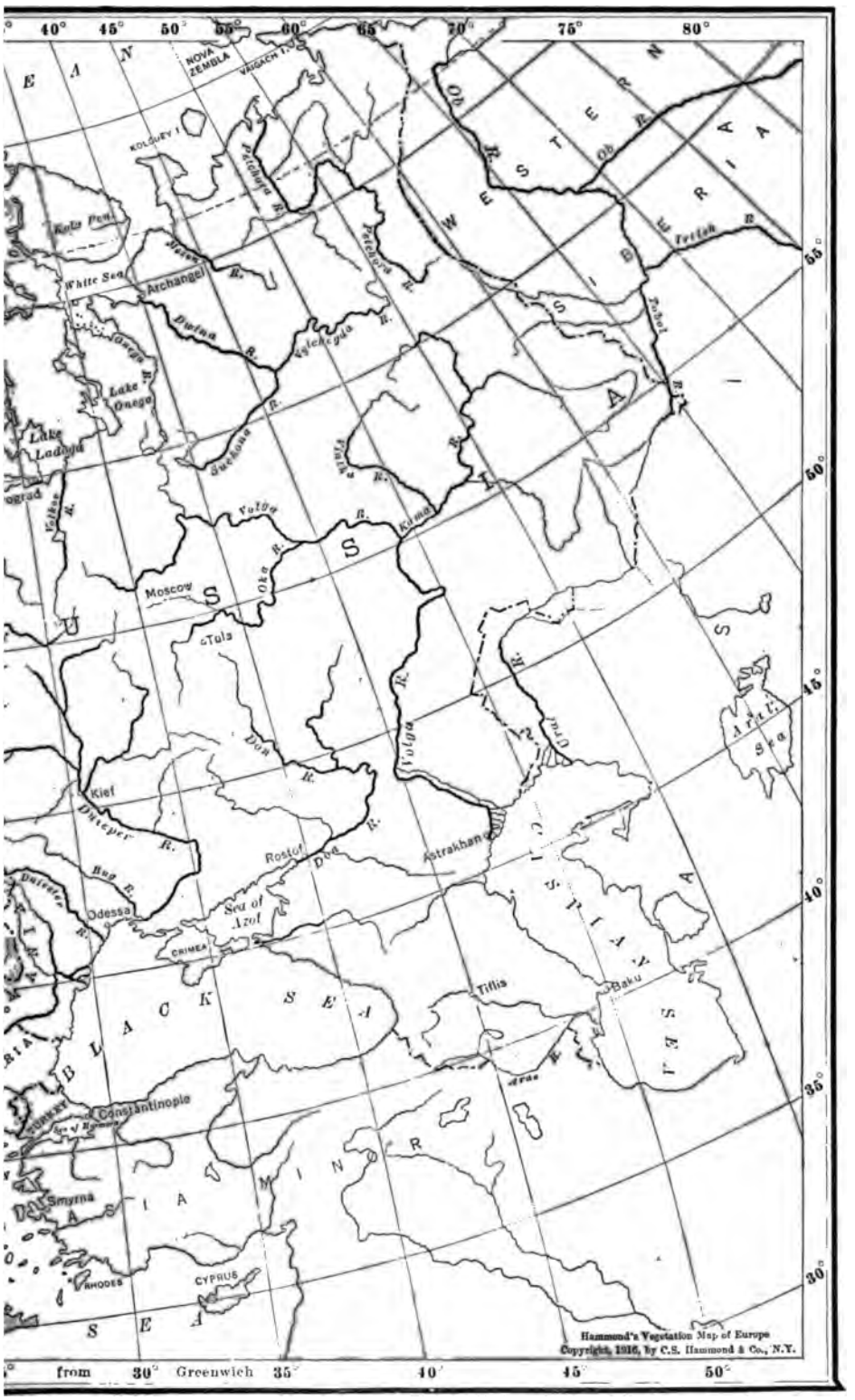
ARCTIC CIRCLE
ICELAND
Reikiavik
FAROE IS.
SHETLAND IS.
ORKNEY IS.
HEBRIDES
BRITISH ISLES
NORTH SEA
Glasgow
Dundee
Edinburgh
Belfast
Irish Sea
Dublin
Liverpool
Manchester
Hull
Birmingham
London
Amsterdam
The Hague
Bremen
Hamburg
Berlin
Essen
Leipzig
Prague
Plymouth
Lands End
C. Clear
Cork
St. Georges Channel
English Channel
Southampton
Antwerp
Havre
Paris
Loire R.
BAY OF BISCAY
FRANCE
Bordeaux
Lyon
Danube R.
SWITZERLAND
Genoa
Marseille
CORSICA
Rome
Naples
SARDINIA
Palermo
SICILY
C. Finisterre
Oporto
Lisbon
PORTUGAL
SPAIN
Madrid
Valencia
Barcelona
BALEARIC IS.
MINORCA
MAJORCA
IVIZA
Strait of Gibraltar
Malaga
MEDITERRANEAN
ATLANTIC OCEAN
ARCTIC
AFRICA
West
25° 20° 15° 10° 5° 0° 5°
55° 50° 45° 40° 35° 30°
10° 5° 0° 5° 10° 15°



NOVA ZEMBLA
VAIGACH I.
KOLGUEV I.
Kola Pen.
White Sea
Archangel
Dwina R.
Onega R.
Lake Onega
Lake Ladoga
Volkov R.
Petchora R.
Vyichegda R.
Suchona R.
Vinka R.
Volga R.
Kama R.
Oka R.
Moscow
Tula
Don R.
Kief
Dnieper R.
Bug R.
Dniester R.
Odessa
Rostof
Sea of Azof
CRIMEA
Astrakhan
Ural R.
Tiflis
Baku
Arac R.
Constantinople
Smyrna
RHODES
CYPRUS
Ob R.
Irtish R.
Tobol R.
Aral Sea
BLACK SEA
CASPIAN SEA
ASIA MINOR
WESTERN SIBERIA
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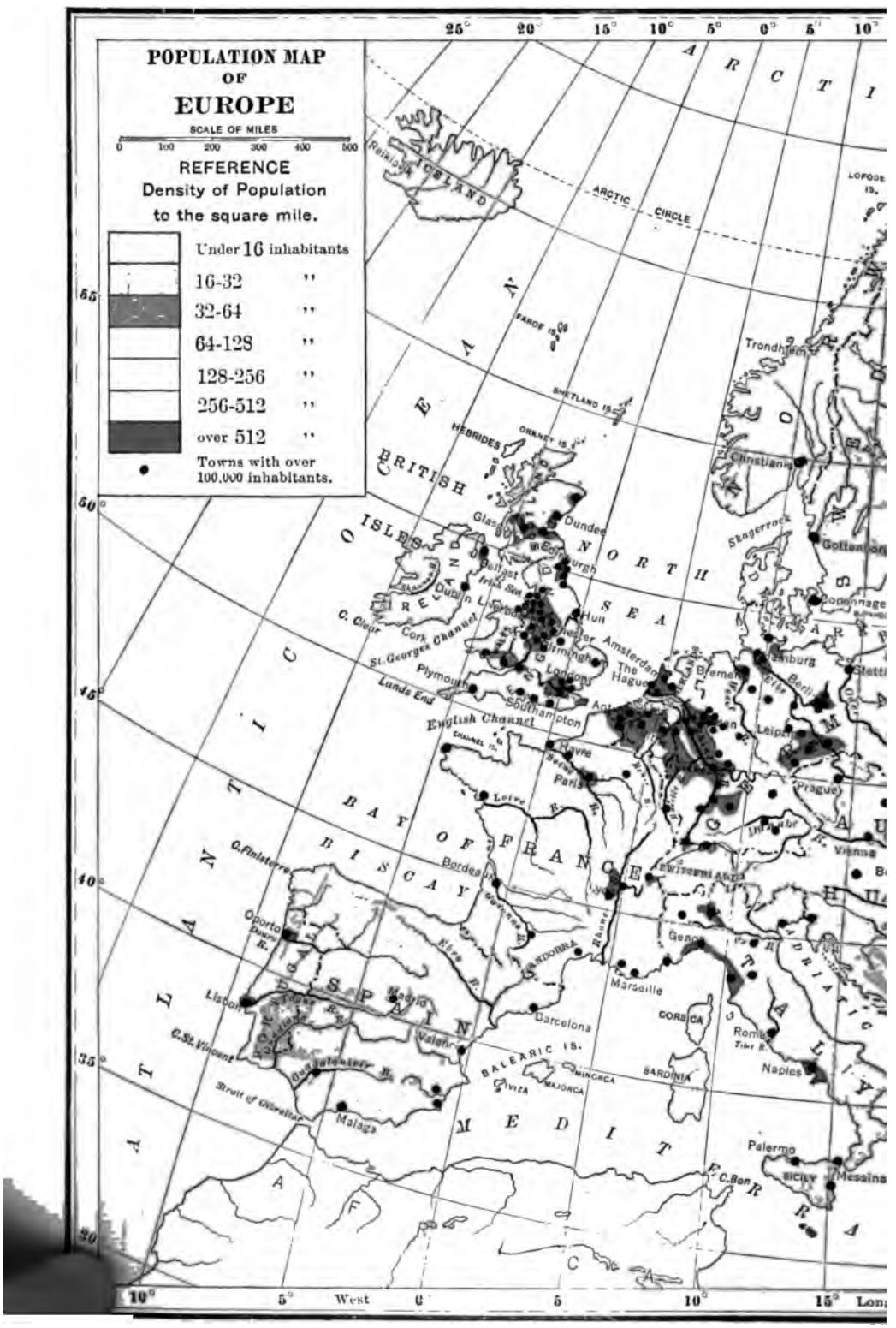
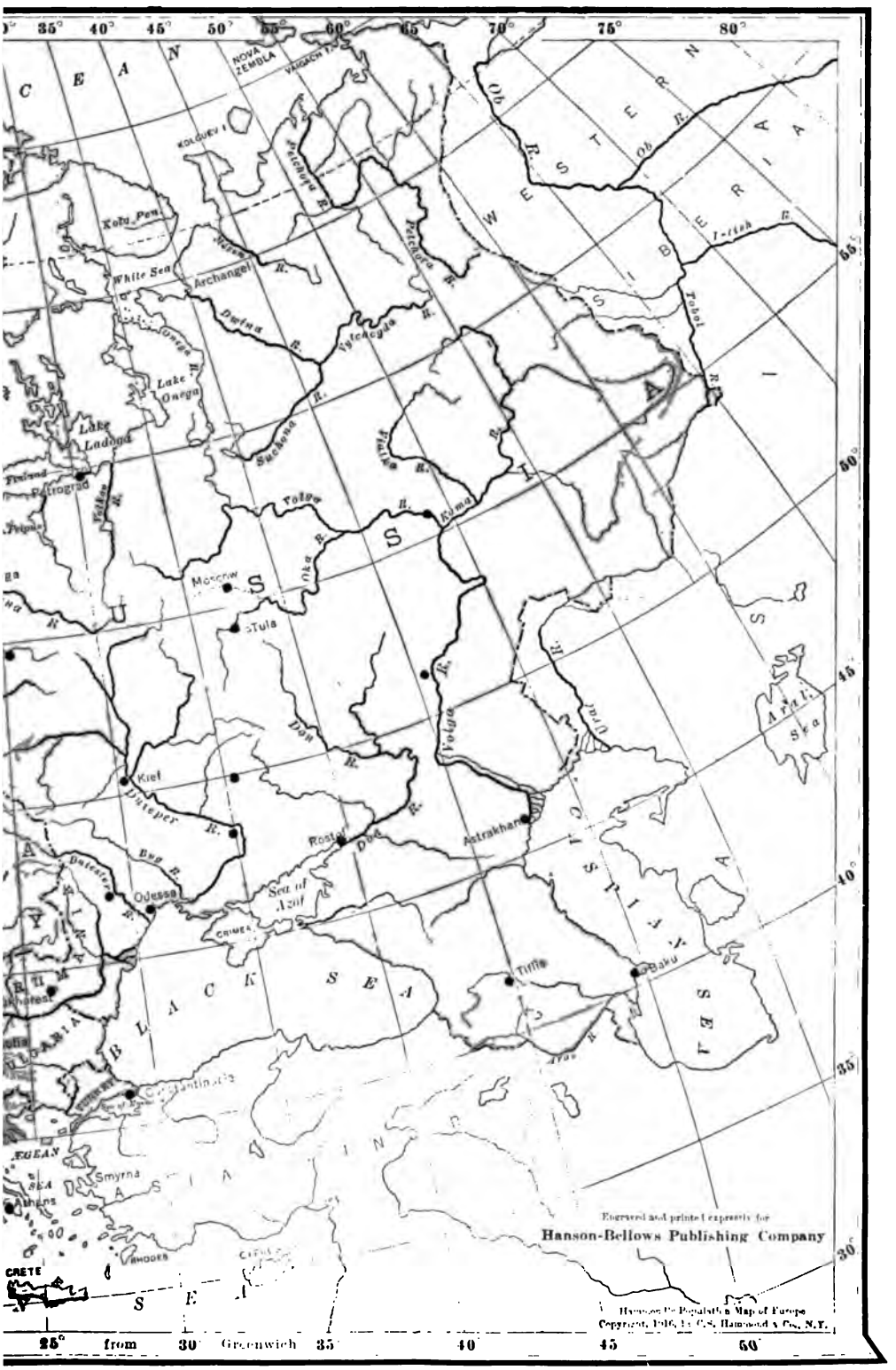
from Greenwich


POPULATION MAP
OF
EUROPE
SCALE OF MILES
0 100 200 300 400 500
REFERENCE
Density of Population
to the square mile.
Under 16 inhabitants
16-32 "
32-64 "
64-128 "
128-256 "
256-512 "
over 512 "
Towns with over 100,000 inhabitants.
ICELAND
ARCTIC CIRCLE
FAROE IS.
SHETLAND IS.
HEBRIDES
ORKNEY IS.
BRITISH ISLES
NORTH SEA
Trondhjem
Christiania
Skagerrack
Copenhagen
Hamburg
Bremen
Leipzig
Prague
Vienna
Glasgow
Dundee
Edinburgh
Belfast
Irish Sea
Dublin
Liverpool
Hull
Chester
Birmingham
Amsterdam
The Hague
London
Plymouth
Lands End
Southampton
English Channel
Havre
Paris
Loire R.
BAY OF BISCAY
FRANCE
Bordeaux
Lyon
SWITZERLAND
Genoa
Marseille
Barcelona
Madrid
Valencia
Lisbon
Oporto
C. Finisterre
C. St. Vincent
Strait of Gibraltar
Malaga
SPAIN
BALEARIC IS.
MINORCA
MAJORCA
IVIZA
CORSICA
SARDINIA
Rome
Naples
Palermo
SICILY
Messina
C. Bon
ATLANTIC OCEAN
MEDITERRANEAN
ARCTIC
AFRICA
West
Long



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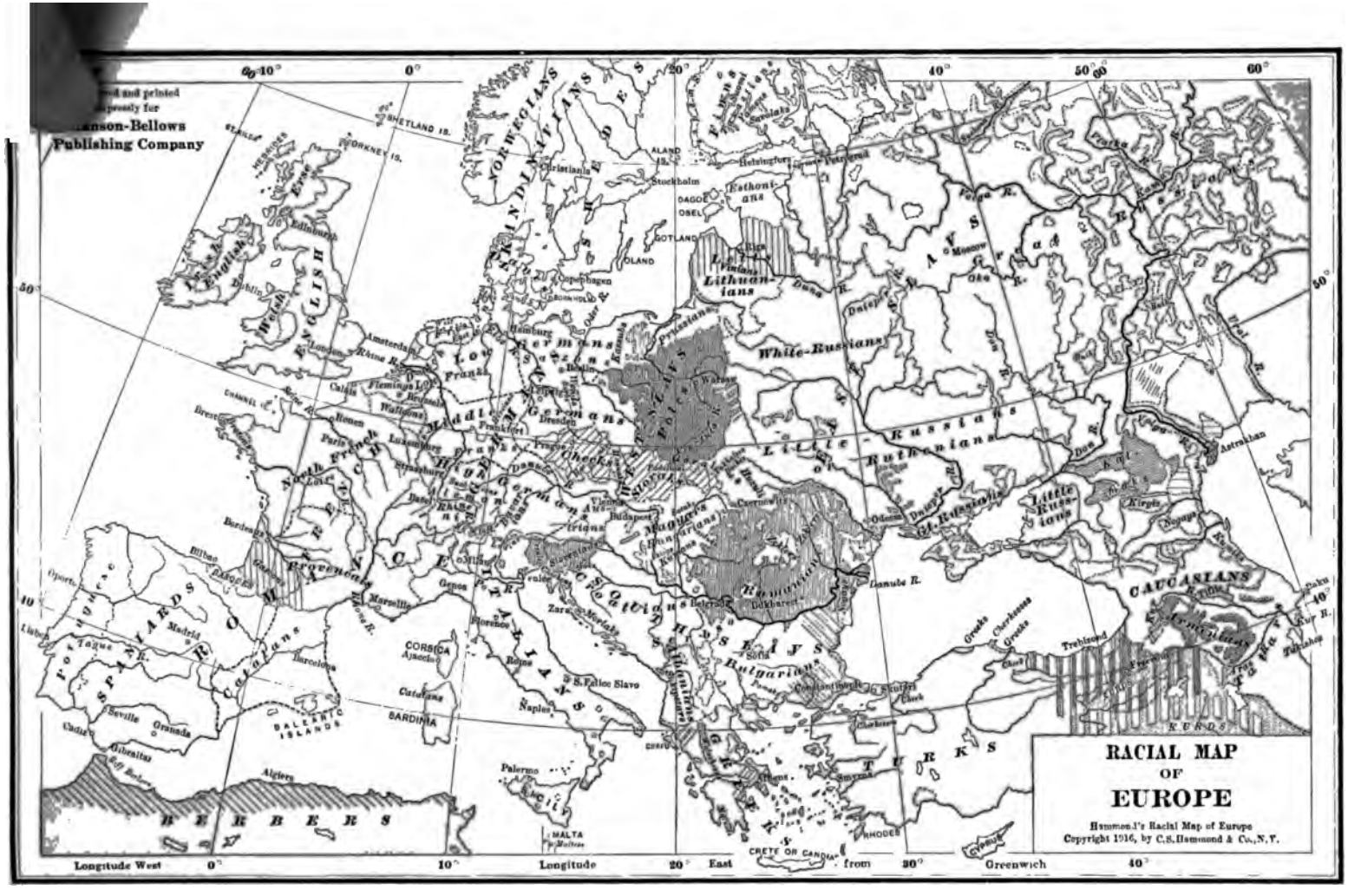
25° from 30° Greenwich 35° 40° 45° 50°
35° 40° 45° 50° 55° 60° 65° 70° 75° 80°
NOVA ZEMBLA
VAIGACH I.
KOLGUEV I.
Kola Pen.
White Sea
Archangel
Petchora R.
Dwina R.
Onega R.
Lake Onega
Lake Ladoga
Petrograd
Volkov R.
Suchona R.
Vyichegda R.
Volga R.
Kama R.
Moscow
Tula
Oka R.
Don R.
Kief
Dnieper R.
Bug R.
Dniester R.
Odessa
Rostov
Sea of Azof
CRIMEA
Astrakhan
Ural R.
Tiflis
Baku
Aras R.
Ob R.
Irtish R.
Tobol R.
Aral Sea
BLACK SEA
CASPIAN SEA
ÆGEAN SEA
Smyrna
Athens
RHODES
CRETE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RACIAL MAP OF EUROPE
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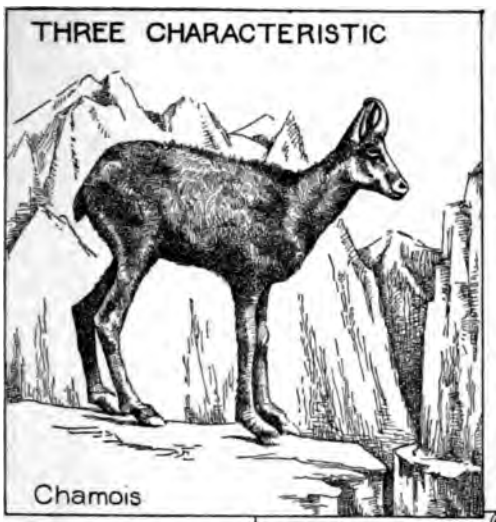
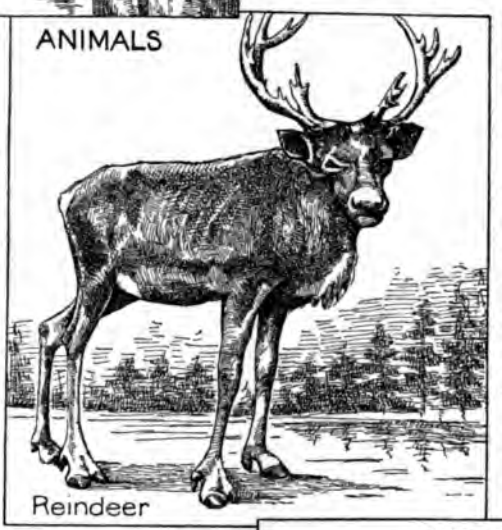
Longitude West
Longitude East from Greenwich
SCANDINAVIANS
FINNS
ESTHONIANS
LETTS
RUSSIANS
ENGLISH
WELSH
IRISH
SCOTCH
FLEMINGS
WALLOONS
DUTCH
GERMANS
POLES
CZECHS
MAGYARS
ROUMANIANS
SERVIANS
BULGARIANS
GREEKS
TURKS
ARMENIANS
CAUCASIANS
KURDS
FRENCH
SPANIARDS
PORTUGUESE
CATALANS
BASQUES
BERBERS
CORSICA
SARDINIA
BALEARIC ISLANDS
CRETE OR CANDIA
RHODES
MALTA



more potatoes and more sugar than any other continent.

Animal Life. With the advance of civilization and increasing density of population many of the large animals once found on the continent became extinct. Representative mammals that have survived are the lynx, bear, beaver, badger, otter, reindeer, elk, the Alpine chamois and marmot, the wolf (found in large packs in Poland, Hungary and Russia), the civet, fox, marten, ermine, polecat, squirrel, hare, rabbit, mole and hedgehog. Among the domestic animals the horse, pony, goat, ass, ox, mule, sheep, chicken and hog are most important. Bird life is abundant, and is represented by thrushes, finches, snow buntings, house sparrows, linnets, magpies, kingfishers, wood pigeons, canaries, eagles, falcons, owls, ravens, storks and many others. Reptiles are comparatively rare. Fish abound in the fresh and sea waters.

Mineral Wealth. Abundant stores of those minerals which are of most value to man underlie the surface of this continent, which in its total output exceeds any other grand division. Over a thousand million dollars worth of coal is usually mined each year, and iron of about half that value. In many instances these two, upon which rest so many of the industries of modern life, occur near each other, and it is impossible to estimate the extent to which the progress of the continent has been dependent upon that fact. Gold, copper, lead and zinc are also mined in considerable quantities, and Europe produces about half as much petroleum as does the United States. Of that valuable mineral, platinum, about ninety-five per cent of the entire world supply comes from the Ural Mountains, and Spain is the world's greatest producer of quicksilver. Most of the mountainous countries contain, in addition, extensive quarries of building stone, and Italy abounds in marble.



Political Divisions. Of the twenty-six states of Europe, thirteen are kingdoms. These are Great Britain, Spain, Italy, Greece, Belgium, Holland, Norway, Sweden, Denmark, Bulgaria, Serbia, Montenegro and Rumania; four are empires—Germany, Austria-Hungary, Russia and Turkey. The last-named has most of its territory in Asia, and only its capital is in Europe. Five republics are France, Switzerland, Portugal, San Marino and Andorra; and there are four principalities—Luxemburg, Albania, Monaco and Liechtenstein.

History of Europe

To give a detailed history of a great continent in a few brief paragraphs would be impossible, and it is, moreover, unnecessary, for the history of each country is given in a separate article in these volumes. But there are certain movements which have affected the continent as a whole, or a large part of it, which are worth noting here.

Ancient Times. Though the earliest civilization of Europe undoubtedly came from Asia, crossing from Phoenicia by way of the islands of the Aegean, the Greeks developed it to a point which it had never before reached. Indeed, in many respects it has never been surpassed in all the centuries that have followed. From the very first, civilization showed that trend which Bishop Berkeley described so long afterward in his famous epigram:

Westward the course of empire takes its way:

and the lands along the Mediterranean were the first in which it developed. After Greece, with its ideal of beauty—a well-rounded beauty which demanded that body, mind and the aesthetic sense be trained—came Rome, with its emphasis on strength, or power. The Romans invented no new forms of government—the Greeks had anticipated every form which Europe has since known—and they made no advance in art and little in literature; but they did excel the Greeks in their genius for organization and for the formulation of law. "Of all European history, Rome is the center," says the historian Gibbon, and it is true that a comprehension of the institutions and the political history of the later nations is impossible without a knowledge of the great work of Rome. In its most flourishing period the Roman Empire included not only Italy but Greece, Spain, Portugal, France, Switzerland, Albania, Serbia, Bulgaria, Turkey, the British Isles, Belgium, Holland, Hungary, and much of Germany, Austria and Rumania, and the unity thus established made possible that spread of Christianity which has had so great an influence on the development of Europe.

With the decline of the Roman Empire there began a troubled time—a period of migration among the northern tribes. The Saxons and Angles established themselves in Britain, the Franks in Gaul (France), the Ostrogoths and Lombards in Italy and the Visigoths in Spain.

Medieval Period. The establishment by [illegible]nagne (771-814) of a great Germanic empire (see CHARLEMAGNE; HOLY ROMAN EMPIRE) which included present-day France, Switzerland, Belgium and Holland, and much of Austria, Italy and Germany, was an event of great significance, but the state which he had created did not endure beyond his time, and its breaking up was really the foundation of the kingdoms of France and Germany.

Meanwhile, the Christians of Europe had come into contact with the Saracens, enthusiasts of another faith who were attempting to sweep over Europe. Held back from Western Europe, these latter still had a weapon against the Christians in their possession of the Holy Land, and to wrest this from them the nations of Europe organized successive crusades (see CRUSADES); these failed in their primary purpose, but were of the utmost importance in acquainting Europeans with the civilization and the science of the East. In Eastern Europe the Ottoman Turks had gained foothold by capture of Adrianople in 1356, and this, together with the unsettled conditions at Constantinople, which was finally taken by the Turks in 1453, gave a strong impulse to learning in Western Europe, because it drove into exile the learned Greeks, with their store of precious manuscripts from the past.

Modern Europe. The transition from the medieval to the modern world did not occur in any definite year, but gradually, during a period extending roughly from the thirteenth to the sixteenth century. In these centuries the ideas and habits of men, their relation to the world about them and to one another, underwent a radical change. There was an awakening in almost every department of life. A great revival of art and letters occurred. The printing press was invented; America was discovered in 1492; the Reformation made men's minds alive to religion and laid the foundation for a new type of intellectual freedom. First one nation, then another, held first rank in Europe; Spain, then France, then England became prominent, and in the meantime two new states, Prussia and Russia, were increasing their strength and territory. Nothing in all history is more interesting than the accounts of the beginnings of all these modern states—the struggles through which they found themselves.

By the end of the eighteenth century most of them were fairly well established, but the struggles continued. There was the French Revolution (which see), which involved all

Europe and brought about the dissolution of the old Holy Roman Empire; the establishment of Greek independence; the disappearance of Poland as a separate state; the division of Holland and Belgium into two states; the unification of Italy, brought about largely through the genius of Cavour; the work of Bismarck and the Franco-German War, which resulted in the consolidation of the German states into an empire, and the establishment of the third republic in France; the war of 1897 between Turkey and Greece; the Spanish-American War, which left Spain almost without colonies; the South-African War, by which the interests of England in South Africa were greatly advanced; the Russo-Japanese War, which brought to a close the domination of Russia in Manchuria and elsewhere in the Far East, and showed the nations of Europe that Japan was a power to be reckoned with; the insurrection of the Young Turks and the deposition of Abdul-Hamid; the annexation of Bosnia and Herzegovina to Austria, and the Balkan Wars, by which Turkey lost practically all of its territory in Europe.

It seemed, at the opening of the second decade of the twentieth century, as if peace among the great powers were secure. Several of them, notably Germany, France, Russia and Great Britain, were constantly adding to their armies and navies, but it was contended that that fact lessened rather than increased the chance of war. But in the summer of 1914 there broke out a conflict which dwarfed all others the world has ever seen. This is rightly called the War of the Nations, for nearly every state in Europe became directly concerned in it. What its outcome will be, what readjustments it will make, it is impossible now to predict, but one thing is certain: it will be many years, perhaps generations, before Europe recovers from its devastating effects. Agriculture, industries, commerce, art, literature—all suffered; while in every country involved the very strongest and ablest men fell. Over two million had been killed on the field of battle before the end of 1916, and more than three times that number had been so seriously wounded that they will be entire or partial charges on society the remainder of their lives. This most terrible of all conflicts is described in the article WAR OF THE NATIONS. W.E.L.

Consult, for history, Freeman's *Historical Geography of Europe;* Ogg's *The Governments of Europe.* For physical features, Mill's *International Geography;* Suess's *The Face of the Earth.* For books on various parts of Europe, see articles dealing with the several countries.

Related Subjects. The articles in these volumes relating to Europe are very numerous, and not all of them can be given here. The articles on cities and towns, on products, and on history, for instance, will be found listed in the indexes accompanying the articles on the various political divisions. The more general topics are here listed and classified:

COAST WATERS

Adriatic Sea	Caspian Sea
Aegean Sea	Cattegat
Arctic Lands and Seas	Dardanelles
Atlantic Ocean	English Channel
Azov, Sea of	Gibraltar, Strait of
Baltic Sea	Marmora, Sea of
Biscay, Bay of	Mediterranean Sea
Black Sea	North Sea
Bosporus	Skagerrak
Bothnia, Gulf of	White Sea

LAKES

Avernus	Lugano, Lake
Constance, Lake	Maggiore, Lake
Geneva, Lake	Neuchâtel, Lake of
Ladoga, Lake	Onega, Lake
Lucerne, Lake of	Zurich, Lake

MOUNTAINS

Alps	Matterhorn
Apennines	Mont Blanc
Balkan Peninsula	Olympus
Black Forest	Parnassus
Carpathian	Pyrenees
Caucasus	Riesengebirge
Cenis, Mont	Rosa, Monte
Cevennes	Saint Gotthard
Harz	Sierra Nevada
Helicon	Ural
Jungfrau	Valdai Hills
Jura	Vosges

PEOPLES

Angles	Magyars
Anglo-Saxons	Races of Men
Basque	Ruthenians
Celts	Samnites
Czech	Slavs
Gael	Slovaks
Gypsy	Tartars
Jutes	Teutonic Races
Letts	Turanian

POLITICAL DIVISIONS

Albania	Italy
Alsace-Lorraine	Lapland
Andorra	Liechtenstein
Austria	Lithuania
Austria-Hungary	Luxemburg
Belgium	Monaco
Bulgaria	Montenegro
Denmark	Netherlands, The
England	Norway
Finland	Poland
Flanders	Portugal
France	Prussia
Germany	Rumania
Great Britain	Rumelia
Greece	Russia
Hungary	San Marino
Ireland	Scandinavia

OUTLINE AND QUESTIONS ON EUROPE

Outline

I. Location

(1) Latitude, 36° to 70° 11′ north
(2) Longitude, 9° 27′ west to 66° 21′ east
(3) Relation to Asia

II. Size and Shape

(1) Smallest of continents except Australia
(2) Greatest length, north and south, about 2,400 miles
(3) Greatest breadth, east and west, 3,293 miles
(4) Area
  (a) Actual
  (b) Comparative
(5) Triangular shape
(6) Closeness of most parts to sea

III. Physical Features

(1) Coast waters
  (a) Length of shore line
  (b) Importance of coast waters
(2) Surface relief
  (a) General trend of mountains and lowlands
  (b) Absence of extremes in heights and depressions
  (c) Chief mountain systems
    1. Effect of mountainous character on history of Southern Europe
    2. The northern highland region
  (d) The great plain
    1. Vast importance
(3) Waters
  (a) Rivers
  (b) Position of watershed
  (c) Lakes

IV. Climate

(1) Only continent which does not extend into tropics
  (a) Comparative mildness of climate
    1. Effect of closeness to sea
  (b) Greater extremes in Russia
(2) Absence of deserts
  (a) Slight necessity for irrigation

V. Vegetable and Animal Life

(1) Widespread vegetation
(2) Zones of forest trees
  (a) Northern cone-bearers
  (b) Oak and beech woods in central part
  (c) Olive characteristic of south
  (d) Agricultural products in which Europe excels
(3) Characteristic animals

VI. Mineral Resources

(1) Continent ranks first in total mineral output
(2) Chief products

VII. The People

(1) No European race
(2) Most of the people Caucasian
(3) The Mongolians
  (a) Magyars
  (b) Finns
  (c) Bulgarians
  (d) Turks
(4) Differences in physical characteristics
(5) Languages
  (a) About sixty different languages spoken in Europe
  (b) Division according to language groups
(6) Religion
  (a) Predominance of Christianity
    1. Three great branches
  (b) Other faiths

VIII. Political Divisions

(1) Kingdoms
(2) Empires
(3) Republics
(4) Principalities

IX. History

(1) Importance of Europe in world's history
  (a) Not the seat of oldest civilization
  (b) Only continent whose people have been progressive
(2) Westward trend of civilization
  (a) The contribution of Greece
  (b) The great importance of Rome
  (c) The western nations
(3) Medieval Europe
  (a) Charlemagne
  (b) Crusades
  (c) Fall of Constantinople
(4) The modern period
  (a) Renaissance
  (b) Reformation
  (c) Inventions and discoveries
  (d) Rise of new kingdoms
  (e) Nineteenth-century readjustments
  (f) The War of the Nations

Outline and Questions on Europe—Continued

Questions

About how many people are there in Europe who are racially connected with the Chinese?

Where do they live?

If there had been no mountains in Southern Europe, how might the history of that region have been different?

How does Europe rank among the continents as regards its production of wheat? Of sugar?

How did the entry of the Turks into the continent actually bring about intellectual benefits?

What is indicated by the difference in the shape of the heads of various European peoples?

In what general way does Europe resemble North America in its relief features? In what way do the two differ?

Is irrigation of as much importance in Europe as in North America?

What part did Charlemagne play in the upbuilding of two of the great states of modern Europe?

What did the ancient Greeks believe was the origin of their ancestors? What connection had this belief with the story of Cadmus?

In what way have the coast waters affected the history of this continent?

What are the relative latitudes of Pittsburgh and Naples? Why is the climate of the latter so much less severe?

In what sense can it be said truly that "Of all European history, Rome is the center"?

If North America were as densely settled as Europe, how would its population compare with its present population?

How does the coastline of Europe compare in length with that of Africa? How do the two continents compare in area?

What is a "continental climate"? Why is this type to be found in Russia and not elsewhere in Europe?

What was the great ideal of Greece? Of Rome?

Since the earliest civilizations did not grow up in Europe, why should that continent be considered the most important in the world's history?

How large a proportion of the inhabitants of the continent do not hold any Christian faith?

What is the longest river of Europe? How does it compare in length with the longest river of North America? Of South America?

Divide the countries of Europe into groups according to their form of government.

With what justice is the War of the Nations called the greatest conflict in the history of the world?

What does the name *Europe* mean? With what other continent name is it in contrast?

Name at least three important events or discoveries that marked the change from the medieval to the modern period.

In what relationship does Europe stand, geographically, to Asia? Is the idea that they are two continents an ancient or a modern one?

Scotland	Sweden
Serbia	Switzerland
Spain	Turkey
	RIVERS
Adige	Oder
Arno	Po
Danube	Rhine
Dnieper	Rhone
Dniester	Rubicon
Don	Saône
Elbe	Save
Garonne	Scheldt
Loire	Seine
Main	Somme
Marne	Tiber
Meuse	Ural
Moselle	Vistula
Neva	Volga

EURYDICE, *u rid' i see,* in Greek mythology, was the wife of Orpheus. After her death from the bite of a serpent, her husband descended into Hades and so charmed Pluto with the music of his lyre that he was permitted to take Eurydice back to earth, on condition, however, that he should precede her on the way to the upper regions and that he should not look behind him. Orpheus, yielding to his natural anxiety, disobeyed this latter injunction, and Eurydice was drawn back into the infernal regions. There is no possible connection between this story and the Bible narrative of Lot's wife, although there is a popular belief to that effect. The tales simply happen to run parallel, so far as is known. A beautiful version of the legend is found in Vergil's *Georgics.* Eurydice and Orpheus are frequently represented in Greek art.

EUSTACHIO, *a oos tah' kyo,* BARTOLOMMEO (? -1576), an Italian surgeon who was one of the founders of modern anatomy. He is particularly famed as the discoverer of the Eustachian tube in the ear, which was named for him (see EAR).

EUTERPE, *u tur' pe,* one of the nine Muses in classical mythology, created by Zeus in answer to a request on the part of the victorious deities, after the war with the Titans, that some special divinities be called into existence to commemorate in song the glorious deeds of the Olympian gods.

Euterpe, whose name means *she who delights,* was the Muse of lyric poetry. She is represented as a virgin crowned with flowers and holding an instrument in her hand, usually a flute. The invention of the flute was attributed to her. See MUSES.

EVANGEL'ICAL ALLI'ANCE, an international association of Episcopalians, Presbyterians, Baptists, Methodists, Independents, Lutherans, Moravians and a few others, formed in London in 1846. It originated in a desire to bring the Protestant Churches in closer touch with each other and extend the Christian faith. Representatives from England, France, Germany, Ireland, Scotland, Switzerland and the United States formed the alliance, and the organization thus commenced has extended throughout the Protestant world. Branches have been established in many countries, the one in America in 1867, and international conferences are held at intervals of two to four years. The alliance has done much to promote religious liberty, especially in Turkey, Russia and Japan, and has broken down many religious barriers.

EVANGEL'ICAL ASSOCIA'TION, a religious denomination, which extends not only into most parts of the United States and Canada, but also into Germany, Switzerland and Japan. It was founded among the Germans in Pennsylvania in 1807, by Jacob Albright. The doctrines, government and methods of worship are much like those of the Methodist Episcopal Church, to which the founder originally belonged. It has bishops, chosen by the general conference of the Church for four years, and ministers appointed each year at the meetings of the annual conferences. In 1891 a division occurred in the membership, after a controversy of several years in regard to the methods of management, and about 40,000 members withdrew to form the United Evangelical Church. At present the Evangelical Association has nearly 112,000 members, while the other branch has 75,000. Since many of the members are English-speaking, the Church papers, published in Cleveland, are printed in both German and English.

EVANGELINE, *e van' jel in,* one of the most popular poems ever written by an American, a metrical story of Gabriel and Evangeline, two lovers whose tragic history is founded on the historic conquest of Acadia (Nova Scotia) by the English. It is read by those who love the musical verse, for its beautiful, smooth-flowing lines, and by those who want merely a story, for the strength and pathos of its "mournful tradition still sung by the pines of the forest." It is by Longfellow, and was his first long narrative poem. Hawthorne had heard the tale of the lovers, driven from their home by the British expulsion order in 1755, and of their long search for each other which ended only when Gabriel lay on his deathbed. He

EVANGELINE: A PLAN FOR STUDY

The following outline may well serve as a model for similar study plans on other poems which are commonly read in school. *Evangeline* has been chosen because it is such a general favorite.

OUTLINE OF THE POEM

Introduction. This not only gives the background, the forest primeval, but tells the reader that the story which follows is a sad one. Which lines indicate this?

Part the First

I.

(1) "The little village of Grand-Pre" described.
(2) Description of Evangeline.
(3) Her home.
(4) Her accepted lover.

II.

(1) The coming of winter.
(2) The visit of Gabriel and his father to Evangeline's home.
(3) First mention of the English ships.

III.

(1) The notary comes to draw up the marriage contract.
(2) He tells his story of justice.
(3) The drawing of the contract.
(4) The last peaceful evening.

IV.

(1) The feast of betrothal.
(2) The gathering at the church.
(3) The deportation proclaimed.
(4) "Strife and tumult of angry contention."
(5) The rebuke of Father Felician.
(6) Dismay in the village.

V.

(1) The deportation.
(2) Evangeline and Gabriel separated.
(3) The blazing village.
(4) Death and burial of Benedict.

Part the Second

I.

(1) The Acadians, "scattered, like flakes of snow."
(2) Rumors of Gabriel.
(3) Beginning of the long search.

II.

(1) The voyage down the Mississippi.
(2) Gabriel's boat passes the anchored raft of the Acadians in the night.

III.

(1) Basil the herdsman.
(2) Meeting of Evangeline with Basil.
(3) "Gone? is Gabriel gone?"
(4) The joyous feast of the reunited Acadians.
(5) The "olden memories" of Evangeline.
(6) Evangeline and Basil begin their search for Gabriel.

IV.

(1) The journey into the Ozarks.
(2) The sympathy of the Indian woman.
(3) The Jesuit Mission.
(4) "Evangeline stayed at the Mission."
(5) "Yet Gabriel came not."
(6) The long search continued.

V.

(1) The search relinquished.
(2) Evangeline joins the Sisters of Mercy.
(3) The city in the grip of pestilence.
(4) Evangeline's visits to the almshouse.
(5) She sees Gabriel, dying.
(6) The farewell.

TOPICS FOR STUDY

After the preliminary hasty reading and a subsequent, more careful reading, the following topics should be taken up. It is not necessary to preserve this order.

(1) *Time and Place.* What is the historic setting of the poem? Is this correctly and accurately given?
(2) *Characteristics* of Acadian people and their mode of life.
(3) *Description.* Does the author make you *see* things? Select especially fine descriptive passages.
(4) *Characters.* Which is the best drawn of the characters? Do they seem real? Are you interested in their troubles?
(5) *Narrative.* Is the author a good story-teller? Does his narrative move, or is it halted too frequently?
(6) *Meter.*
(7) *Figures of Speech.* Are there "Homeric" similes—long-sustained comparisons? Does the author prefer the simile or the metaphor?
(8) *Allusions.* Which are more numerous, those from the Bible, from mythology or from history? See that the children understand them all, or much of the force and beauty is lost.
(9) *Unusual words.*

had considered weaving a novel about it; feeling, however, that it was better suited to poetic treatment, he offered it to Longfellow, who made of it an exquisite idyl. The meter chosen was that of the classic epics, the *Iliad* and the *Aeneid,* and the lines are long and stately. Some of them, as the opening ones, for instance, are as familiar as any lines in the English language:

This is the forest primeval. The murmuring pines and the hemlocks,
Bearded with moss, and in garments green, indistinct in the twilight,
Stand like Druids of eld, with voices sad and prophetic,
Stand like harpers hoar, with beards that rest on their bosoms,

The pathos of Evangeline's search for Gabriel through many hundreds of miles of forest and city, down river and bayou, and of her final discovery of him on his deathbed rings true and is never strained. Many a line is worth remembering for its true poetic quality, as—

When she had passed, it seemed like the ceasing of exquisite music.

Silently one by one, in the infinite meadows of heaven,
Blossomed the lovely stars, the forget-me-nots of the angels.

EVANS, Mary Ann or Marian. See Eliot, George.

EVANS, Robley Dunglison (1846-1912), an American naval officer, who was known by the popular name, "Fighting Bob." The boy who was to become Rear-Admiral Evans was born in Virginia and was appointed to the United States Naval Academy in 1860. At the age of seventeen, he, a Virginian, was a midshipman in the United States navy, while his brother fought on the side of the Confederacy.

ROBLEY D. EVANS

In 1868 Evans was commissioned lieutenant-commander; in 1870-1871 he was on duty at the navy yard at Washington, and in 1871-1872 at the Naval Academy at Annapolis. He was made commander in 1878, in 1891 was in command of the *Yorktown* at Valparaiso, Chile, and in 1893 became a captain. During the Spanish-American War Evans was in command of the *Iowa,* and at the naval Battle of Santiago took an important part in the destruction of Cervera's fleet. He was commissioned rear-admiral in 1901, and in 1902 was made commander of the Asiatic fleet, with the *Kentucky* for his flagship.

Although the nickname "Fighting Bob" was merited early in his career, it was not given to him until 1891, when he was sent to Valparaiso in command of the *Yorktown* to help Captain Schley in a fight which the latter's men got into with the Chileans. During the absence of the *Baltimore,* Evans with his single gunboat confronted the ten forts and the whole Chilean squadron, and twice cowed the Chileans with the threat to open fire, thus saving his flag from insult and preventing the forcible seizure of the American refugees.

When President Roosevelt sent the American battle fleet around the world on a mission of peace and good will, Rear-Admiral Evans commanded it around Cape Horn and up the Pacific coast to California, when he relinquished his duties, having reached the age of retirement, sixty-two years.

EVANSTON, *ev'anz tun,* Ill., a residential city of Cook County, one of the most beautiful suburbs of Chicago, situated twelve miles north of the center of that city, along the shore of Lake Michigan. The population in 1910 was 24,978; in 1916 it was estimated to be 28,591. It is served by the Chicago & North Western and the Chicago, Milwaukee & Saint Paul railroads, and is connected with Milwaukee by an electric line, and with Chicago by elevated and surface lines.

Evanston is a city of wide, beautifully-shaded streets, attractive homes and churches and well-known educational institutions. It is the seat of Northwestern University (which see), attended by over 5,000 students, and the largest Methodist Episcopal school in the United States, and of three affiliated schools, the Garrett Biblical Institute, the Norwegian Danish Theological School and the Swedish Theological Seminary. Winchell Academy, the Convent of Visitation and the Cumnock School of Oratory, the latter affiliated with the university, are also located here. The Willard Rest Cottage is the headquarters of the National Woman's Christian Temperance Union; the city was the home of the founder of the organization, Frances E. Willard.

Evanston was incorporated as a town in 1863 and as a village in 1872, and received a city charter in 1892. The water and filtration plant is owned by the city.

EVANSVILLE, *ev'anz vil,* IND., the county seat of Vanderburgh County and an important manufacturing center, on the Ohio River. It is the second largest city in the state, ranking next to Indianapolis. In 1910 the population was 69,647 and in 1916 it was estimated to be 76,078. The city is in the southwestern corner of the state, 150 miles directly southwest of Indianapolis, 163 miles east by south of Saint Louis, Mo., and 155 miles by rail and 200 miles by the river west of Louisville, Ky.

Evansville is on six trunk lines—the Chicago & Eastern Illinois; the Cleveland, Cincinnati, Chicago & Saint Louis; the Southern; the Louisville & Nashville; the Illinois Central and the Evansville & Indianapolis railroads—and is the terminus of several interurban electric roads. Two belt lines connect the industrial plants of the town with all of the railroads. Six steamboat lines make Evansville their home port.

Within the city limits there are five soft-coal mines, and within a radius of fifty miles there are about sixty such mines. This advantage, together with the shipping facilities to points north, south, east and west, by rail and river, and abundant water power furnished by a $2,000,000 government dam above the city, gives the place great importance as a shipping and manufacturing center. There are 400 factories, employing 12,000 workers. Evansville is a great wheat market and the second largest hardwood lumber market in the world; its saw mills cut and ship lumber, notably Indiana quartered oak, to all parts of the United States and Europe. The largest industrial enterprises are manufactories of furniture.

The prominent buildings are a courthouse (the largest in the state), a customhouse, city hall, United States Marine Hospital, a state hospital for the insane, the Elks' Home, Saint Mary's and Deaconess hospitals, three Carnegie libraries, the Willard Public Library and the Little Sisters' Home for the Aged. In 1916 a fund was secured by county bonds and popular subscription for the erection of a Coliseum costing $150,000.

Evansville was founded in 1816 by General Robert M. Evans. It was incorporated as a city in 1847 and reincorporated in 1905. The completion of the Wabash and Erie Canal in 1853, from Evansville to Toledo, Ohio, a distance of 400 miles, contributed greatly to the growth of the city. Evansville is built too high above the river to suffer from the occasional overflows of the Ohio.

EVAPORATION, *e vap o ra'shun.* When water is left standing in an open dish in a warm room it soon "dries up"; damp clothes hung on a line in the sunshine lose all their moisture in a short time. The water in them is changed to vapor by the heat in the atmosphere, and the warmer and drier the surrounding air the more rapidly this process, called *evaporation,* takes place. With a high temperature there may be a great deal of vapor in the air; for instance, at 90° there may be almost twice as much as at 70°. At freezing point there is very little, but a certain amount of moisture must always be in the atmosphere, for no living thing could exist in perfectly dry air. When all the vapor that can exist at a particular temperature is present, the air is *saturated,* or at *dew-point,* but this seldom happens except when it is raining. Evaporation takes place at any temperature from the surface of a liquid, for even ice and snow send off vapor, which is especially noticeable on a day after a snowstorm when the temperature rises suddenly.

Air containing much moisture is said to be *humid,* although as a general thing the amount is much less than that required for *saturation.* The extent of this humid condition, or *humidity,* in tropical regions is very great, especially near the sea, while in cooler climates it is much less. A person can withstand a great deal more cold in air which contains very little vapor; this explains why cold winds blowing over water seem more penetrating than winds farther inland in the same temperature. Without water, plants and animals cannot live, and large areas would be uninhabitable if it were not for rain produced by the water which evaporates from the oceans, lakes, rivers, ponds and moist earth.

The humidity in the air is often shown by clouds. If they form rapidly, or if small patches of cloud increase rapidly in size, the humidity is increasing; while if the cloud area is becoming smaller, it is highly probable that the air is becoming drier. The moisture which plants absorb through their roots evaporates mainly through the leaves, and in them the process is called *transpiration* (see LEAVES). The more leaf surface exposed, the more rapid will be the transpiration, but the structure of the leaf, as in the pine needle, often prevents very rapid transpiration. In other cases the amount of water which evaporates is immense, as in a beech tree 110 years old, which was estimated as transpiring 2,250 gallons in one summer.

Other liquids, such as ether, ammonia and alcohol, evaporate more rapidly than water, leaving their surfaces very cold. It is on this principle that ammonia is used in cold storage plants (see COLD STORAGE). C.R.M.

EVARTS, *ev'arts,* WILLIAM MAXWELL (1818-1901), an American statesman, lawyer and orator of high rank. He was graduated at Yale in 1837, studied law at Harvard, and was admitted to the bar in New York City in 1841. From July, 1868, until March, 1869, he was Attorney-General of the United States; in 1872, counsel for the United States in the *Alabama* claims arbitration. Previously he had won a high reputation as chief counsel for President Johnson in his impeachment trial. During President Hayes's administration he was Secretary of State. Evarts was elected to the United States Senate from New York in 1885 and served until 1891, when he retired to private life.

EVENING SCHOOLS. See SCHOOLS, subtitle *Special Schools.*

EVENING STAR, HESPERUS, or VESPER, the name given to the planet Venus, which appears as the first star of evening when it is on the east of the sun and as the last star of the morning when it is on the west. When Venus becomes the morning star its position as evening star is occupied in turn by Mars, Jupiter and Saturn. The term *evening star* is now popularly and vaguely applied to any bright planet showing above the horizon early in the evening.

VIEWING THE SUMMIT OF EVEREST

EV'EREST, MOUNT, the highest peak in the world, in the Himalaya range on the frontiers of Tibet and Nepal, north of British India. *It rises* to a height of 29,002 feet above sea level, a distance of approximately five and a half miles. The mountain has no distinctive native name, but it received the present name in honor of Sir George Everest, surveyor-general of India, who ascertained its height in 1841. Many adventurous mountain-climbing scientists have endeavored to reach the summit of this giant among peaks, but no one has accomplished the feat. (For comparison of the height of Mount Everest with the highest mountains on the moon, see MOON.)

EVERETT, *ev'er et,* EDWARD (1794-1865), an American statesman and author, and one of the greatest orators of his day. He was born at Dorchester, Mass., and received his education in Boston and at Harvard College. He entered the Unitarian ministry at the age of nineteen, but resigned his first pastorate in less than two years. After traveling in Germany and England, he occupied the chair of Greek literature at Harvard College. For four years he was editor of the *North American Review;* then, entering politics, he served five terms in Congress and was elected governor of Massachusetts in 1835. He filled the office of governor for four terms, and was then defeated for reëlection by a single vote.

EDWARD EVERETT

In 1841 Everett was named United States minister to Great Britain, but immediately after Polk's inauguration he was recalled. From January, 1846, to 1849, he was president of Harvard College, and in 1852 became Secretary of State in President Fillmore's Cabinet. Within a few months he was elected United States Senator from Massachusetts, but resigned in 1854. The Constitutional Union party nominated Everett for Vice-President in 1860, but his ticket received only thirty-nine electoral votes out of 303.

It was Everett who was the chief orator at Gettysburg on the day Lincoln delivered his great speech of 279 words. Everett was so amazed at the President's logic and power of condensation that he declared Lincoln's speech would live generations after his own (Everett's) two-hour effort was forgotten.

EVERETT, MASS., a manufacturing city in Middlesex County, situated on the Mystic River, three and one-half miles north of Boston, of which it is a suburb. The Boston & Maine and the Boston & Albany railroads serve the city, and interurban lines connect with Boston, Chelsea, Salem, Lynn and Malden. There are excellent freight facilities by rail and by water. Everett was settled in 1640 and was a part of Malden (being known as South Malden) until 1870, when it was incorporated as a township. In 1892 it was chartered as a city. In 1916 its population was 39,233.

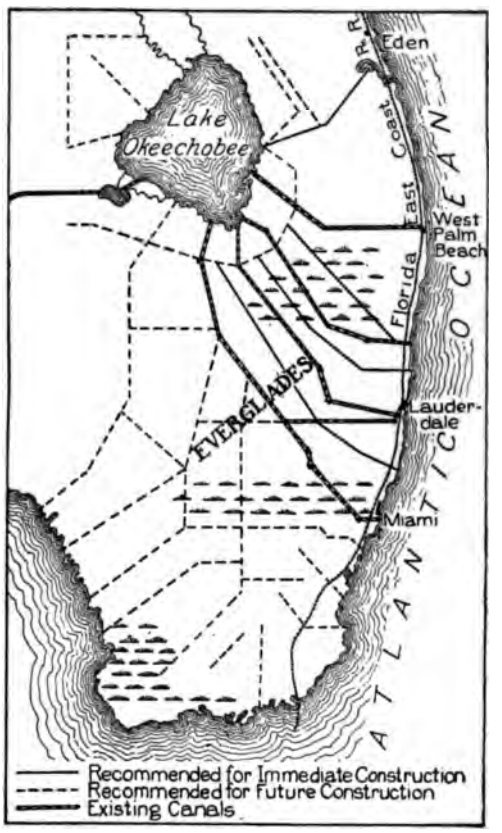
Although Everett is a manufacturing city of importance, it is also an attractive city of homes, for it is within the scope of the boulevard system known as the Metropolitan Parkway, and many Boston merchants have their residences there. It has the Parlin and Shute libraries, the Whidden Memorial Hospital and the Home School for young ladies. Of the varied industries for which the city is noted, the production of gas and coke is in the foremost rank, the coal used being brought from mines in Nova Scotia. L.P.S.

EVERETT, WASH., the county seat of Snohomish County, situated on Puget Sound, at the mouth of the Snohomish River, thirty-three miles north of Seattle. It is served by the Chicago, Milwaukee & Saint Paul, the Great Northern and the Northern Pacific railroads, by electric interurban lines and by steamboats. The population, which in 1910 was 24,814, was estimated to be 35,486 in 1916.

Everett is in a region of extensive pine forests, and lumbering is the chief industry. Here are located some of the largest saw mills in the Northwest. Quantities of red-cedar shingles are exported. Gardening and farming, and the mining of copper, gold and silver are other large interests of the surrounding country. The city has shipyards; ore, paper and flour mills; iron works, sash and door factories, and smelters. In connection with the last is one of the two plants in the United States for the saving of arsenic from smelter fumes. Everett has an excellent harbor, equipped with several iron piers, and has a considerable commerce.

The town was not settled until 1891, but its location, on the Sound and in the great forests, and its railroads contributed to a rapid growth. It was incorporated in 1893 and has since adopted the commission form of government. It contains United States customs and assayer's offices, a Carnegie Library, Y. M. C. A. building, a Lutheran college and two hospitals.

EVERGLADES, *ev'er glayds,* a name commonly given to any swampy, grass-covered area, but applied particularly to a vast, marshy tract in Southern Florida, covering an area about 140 miles long and fifty miles broad.



THE EVERGLADES

The map shows the ambitious plans of Florida for reclaiming at least a part of the area.

Until recently there had been no effort to drain and reclaim this area, larger than some Eastern states of America; but a most remarkable drainage project has now been successfully inaugurated by which thousands of acres of land have already been reclaimed in this district. In many places where there was in 1913 nothing but marsh, lakes and pools, excellent crops of fruit and vegetables are now grown.

The water which caused the formation of the Everglades came from Lake Okeechobee, and from the heavy rains which fall from May to October. The marshy lands were covered to a depth of six feet over much of the area, and nowhere were they habitable. In 1913, five drainage canals had been dug through the

swamp to the Caloosahatchee River, and the higher portions of the land were rendered fit for occupation and agriculture. A total area of 5,000 square miles may eventually be reclaimed, the state of Florida in 1913 having appropriated $6,000,000 for this purpose.

The Seminole Indians, after their subjection in 1842, fled towards the Everglades and for many years were the only inhabitants of what was until recently a most unhealthful and inhospitable region.

Consult *The Everglades of Florida*, a document (No. 89) of the United States Senate, which may be secured from the Government Printing Office, Washington; also, Rhodes and Dumont's *A Guide to Florida*.

EV'ERGREEN, any plant, shrub or tree which wears a dress of green all the year. Deciduous trees (which see) drop all their leaves at a definite season each year, and stand for months bare skeletons of trunk, branches and limbs. Evergreens, however, do not shed old leaves until new ones have formed, so their change of garment is not noticeable; the new leaves push off the old. The leaves of evergreen trees, being called upon to bear exposure to frost, cold and drying winds, are more tough and leathery than leaves of other trees, and, as in the cone-bearing trees (which see), the leaves are needlelike. Needle leaves have less leaf surface exposed than have broad leaves, and thus can more easily resist changes of temperature. They also have abundant green tissue (see CHLOROPHYLL) to absorb life-giving properties.

In warm climates many evergreens keep their leaves for several years. Some of the best known evergreens are those which serve so well and last so long in interior decoration—pines and firs, holly, ivy, box and myrtle. Rhododendrons, some magnolias, and most tropical plants are evergreens. Some of the evergreens, the pines, especially, are among the most valuable timber trees in the world.

EVERLASTING FLOWER, a name applied to various flowers which when picked and dried can be kept for an indefinite time without much change in their appearance. The French call them *immortelles*, and that name is now given in America to flowers of that nature used in wreaths to be placed on graves. See AMARANTH; IMMORTELLE.

EV'IDENCE. Those things which tend to prove the truth or falsity of a fact at issue the basis of all legal trials, whether civil or criminal. *Testimony*, which is the written or spoken declaration of a witness, is only one kind of evidence. Objects which may be inspected by the judge or jury—as, for instance, documents or weapons—may also be evidence. There is almost general agreement as to what constitutes evidence and what kind of evidence is permissible.

It is the business of a judge to decide what evidence is admissible in a case, and frequently much of the time in a trial is occupied by the efforts of opposing lawyers to have certain evidence admitted or excluded. The first requirement of evidence is that it shall have a direct bearing on the question at issue. Sometimes this leads to strange situations. For instance, if a prisoner is charged with stealing a *black* horse, no evidence will be admitted to prove that he took one of another color. *Hearsay* evidence, the statements of one party as to what he heard another say, is legal only in a few special instances. *Oral* evidence cannot as a rule contradict that of documents. *Confessions of guilt* are not admissible as evidence if made with the hope of reward or the fear of punishment.

Prima-facie evidence, or evidence as shown on the face of things, is that which at first view seems to be conclusive, but may be contradicted. Thus the books of original entry of a bookkeeper are evidence that certain sums have been handled in a certain manner, unless other evidence proves them wrong.

Circumstantial Evidence. If the thumb mark of a certain man is found on pieces of counterfeit paper money it is evidence of the circumstance that it has been in his possession, but not necessarily that he has been guilty of passing counterfeit money. Such evidence is called *circumstantial* because, while the crime is to be presumed, nothing direct is conclusively proved. When circumstantial evidence points without reasonable doubt to the commission of a crime a jury is bound to act upon it as though it were *direct* proof. It is the business of the judge to *charge* or instruct the jury what verdict it is entitled to reach from a consideration of the evidence.

EVOLUTION, *ev o lu'shun*, a word once employed in connection with such a simple process as the development or unfolding of a flower. Since the time of Herbert Spencer (which see) it has taken on a different meaning. As commonly used, the term implies the descent of the complex life-forms of to-day from the simpler ones of ages gone. Incredibly slow has been the process, incredibly long

the stretches of time; but somehow, everything that exists to-day has grown out of what existed earlier, just as what is to come must grow out of what exists to-day.

Evolution, then, is simply a process of change through unimaginable periods of time, a change always from the simpler to the more complex. An example or two will make this clear. One of the most useful animals in the world is the horse, and the breeder knows how to take advantage of the laws of heredity to increase this usefulness. If great strength is wanted, or endurance, or fleetness, he can select any one of these characteristics. Geologists have learned that Nature has been at work since before the existence of man, breeding changes in just this manner. Embedded in rocks in various places have been found fossils which show all the steps in this breeding process. The earliest horse bore a certain resemblance in general form to the horse of to-day, but it was little larger than a dog, and it had five toes. Gradually, through the ages, the horses that were largest and strongest tended to live and reproduce, while the smaller, feeble ones died; and so the horse became, little by little, a larger animal. In like manner the toes, because for some good reason they did not help to fit the horse for its environment, were in time replaced by the solid hoof; it is a fact, discovered by geologists and biologists in their study of thousands of instances, that those characteristics which aid an animal in its struggle for existence tend to persist and be strengthened, while those which hinder are gradually eliminated.

Birds and Reptiles. Another very interesting example of this wonderful process of change is to be found in these two widely differing forms of life. That is, they seem to any but the closest student to differ widely, but the biologist knows that there are structural resemblances which prove them closely akin, and the geologist can show in his fossils the connecting forms (see FOSSIL). The reptiles came first, but gradually some reptiles acquired embryo wings, and these were developed in succeeding generations until they became the distinguishing mark of a new order of animals. In the consideration of any such development the time element cannot be too strongly insisted upon. It is a great task which the evolutionist puts on a man's powers of faith when he asks him to believe that all the life-forms of to-day—even man, with his varied activities and his spiritual aspirations—have evolved from such primitive forms as now exist in the amoeba or the hydra (both of which see); but he allows scores of millions of years for the process.

"Descent of Man." It is of interest to know that birds developed from reptiles, but man is far more vitally concerned with the question of his own origin. Darwin, whose name in the popular mind is inseparably linked with the doctrine of evolution, did not hesitate to declare that man and the manlike apes had a common ancestor, and to-day practically every scientist accepts that theory without question. The nonsense verse beloved of children is not only a nonsense verse—it states an acknowledged truth:

> Children, behold the chimpanzee;
> He sits on the ancestral tree
> From which we sprang in ages gone.
> I'm glad we sprang; had we held on
> We might, for aught that I can say,
> Be horrid chimpanzees to-day.

But the series between man and the apes was not complete, and the search for the "missing link" attracted much attention. The fossil remains of primitive men showed that in those far-off days men were in structure, and especially in size of brain cavity, more closely related to the apes than are the men of to-day, but still they were men and not apes. At length, in Java, there were found the fossil remains of an animal which the scientists scarce knew whether to consider man or ape; there developed a general scientific agreement that the missing link had been discovered.

Recent poets, alive to great world-interests, have found in the doctrines of evolution material more fascinating than that afforded by medieval romances, and have dealt with this material in various ways. An American poet, William Vaughn Moody, has conceived of all life as moved from the beginning by—

> A vision, a command, a fatal word:
> The name of *man* was uttered, and they heard.
>
> Upward along the aeons of old war
> They sought him; wing and claw-bone, shank and bill,
> Were fashioned and rejected; wide and far
> They roamed the twilight jungles of their will,
> But still they sought him, and desired him still.

The Religious Objection. There are those of the Christian faith who insist that a belief in evolution and a belief in the Bible cannot go hand in hand. There are others who contend that it implies no lessening of the Creator's powers to state that He worked through such an orderly process as evolution in His

fashioning of the world, instead of performing a series of distinct, more or less unrelated, acts of creation. Not even the most enthusiastic supporter of the doctrine of evolution believes that the whole story is told in such terms as "adaptation," "natural selection," or "survival of the fittest." There is a phase of the question which science has been unable to grasp, a controlling or modifying cause which has never been discovered; and the theory in its entirety no more denies the existence of a Deity than does the strictest form of revealed religion. A.MC C.

Consult Darwin's *The Origin of Species;* also *Descent of Man,* by the same author; Spencer's *Principles of Biology;* Crampton's *The Doctrine of Evolution.*

EVOLUTION, meaning literally, *unfolding* or *unrolling,* is a term applied in mathematics to the process of finding the roots of numbers. A root of a number is one of its equal factors. Evolution is the reverse of *involution,* which is the process of raising a number to any required power (see INVOLUTION). To illustrate, by the process of involution 4 can be raised to the third power by using it three times as a factor; $(4)^3=4\times4\times4=64$. By the process of evolution the cube root of 64 is found to be 4. That is, 4 is one of three equal factors of 64. To indicate the extraction of a root the radical sign ($\surd$) is used. A small number, written in the angle of the radical sign, indicates what root of the number is required. This number is called the *index* of the root. When no index appears square root is understood. Thus, $\sqrt[3]{64}$ means the cube root of 64; $\sqrt[4]{64}$, the fourth root of 64; and so on. The processes of finding the square root and cube root of numbers are explained fully under the headings SQUARE ROOT and CUBE ROOT.

EXCAVATIONS IN ANCIENT LANDS. Throughout the ages, since the very beginning of time, the surface of the earth and the peoples thereon have been changing. Floods, earthquakes, volcanic eruptions and other natural agencies have destroyed and buried places which were once astir with as much life as is seen in villages, towns and cities to-day. Of some of these places we read in Biblical and ancient history, the stories having been written before they ceased to exist; yet the discoveries made through excavations round out those stories more fully. Scientific investigations have revealed, too, that there were prehistoric people also, and Mother Earth holds their story deep within her bosom. But chapter by chapter the interesting story of life is being read backward to the beginning, through excavations in ancient lands.

Little by little the habits, language, religion, culture and arts of ancient civilizations are being revealed. The pick and the shovel bring to light a tablet here, utensils there, in some places well-preserved entire homes, and even *cities. Such fragments,* pieced together, have brought to common knowledge something of the life of the early inhabitants of the United States—the Mound Builders. Excavations have brought to light the existence of prehistoric people in Mexico, Yucatan and Peru. They have told us the story of early Danes and Norsemen, and many others. The countries around the Mediterranean Sea, however, are now yielding and have, since the Middle Ages, yielded the greatest fund of knowledge and some of the most wonderful artistic treasures.

Greece. In the middle of the eighteenth century excavations in Greece disclosed the famous Venus de Milo, the Zeus temple at Olympia and the Athene temple at Aegina. Systematic diggings begun about a hundred years later, in 1869, brought to light the site of ancient Troy, built above the ruins of several other Troys. Work then conducted at Mycenae and Tiryns uncovered the old Greek civilization known as the Mycenaean. Excavations made since then at such historic places as Athens, Delphi, Sparta and Corinth have revealed further interesting facts about a people

who lived from about 1800 B.C. to about 1000 B.C.

Relics found in the island of Crete, however, tell of a civilization which existed before the Mycenaean. It is known as the Aegean and probably existed as early as 4000 B.C.; and relics found still deeper in the earth show that a race of people must have lived in that country about 10,000 years before the birth of Christ.

More recent discoveries in England, Germany, France and Spain have led scientists to believe that human beings lived throughout Europe as long as 100,000 years ago.

Italy. Originally, excavations in Italy were for the purpose of obtaining stone for building, but such diggings gave to the world those wonderful art treasures, the Apollo Belvedere and the Laocoön group, both of which are described in these volumes. In 1736 excavations were begun at Herculaneum and in 1748 at Pompeii, those two early victims of the fire-spitting Vesuvius. Although discoveries in Italy have been slow, excavations at Rome and in Southern Italy have revealed many new facts about the history and civilization of the Rome of long ago.

Biblical Countries. When Napoleon invaded Egypt at the end of the eighteenth century the book of the land of the Pyramids was opened to European scholars. Tablets inscribed in the Babylonian language were discovered, and when the key to the characters became known many interesting facts were brought before students of the Bible. Since the middle of the nineteenth century Assyria, Babylon and Palestine have been favorite fields of extensive excavation. Statues, monuments and tablets have been unearthed, some of which record the stories of Creation and the Flood; others tell about the reigns of ancient kings, such as Sennacherib and Nebuchadnezzar; others throw light on the life and customs of the ancient Canaanites and Israelites. Still others reveal bits of information about a people called the Hittites, and when more of the links in this story are found the history of an ancient and mighty people of Old Testament times will be more clearly revealed.

Recent Excavations. The work of piecing together the fragments of the great motion picture, so to speak, of the world and its peoples, has been going on for centuries. The discoveries of here an old coin, there a quaint piece of jewelry; at another place the wall of a city, or somewhere, perhaps, a burial place, have all added to the sum of human knowledge. The work of the Germans in the Mesopotamian valley, however, commenced in 1899, has perhaps yielded, up to 1914, the most important results. Among them the history of Nebuchadnezzar and his people has been revealed. Many objects of greatest historical value have been discovered, such as five tombs of other Assyrian kings and an old temple of Astarte.

In Egypt, in 1914, one of the oldest tombs of the land was discovered, the mystic tomb of Osiris. In that country valuable bits of manuscript were discovered by the English, among them about ten pages from the Idyls of Theocritus. Two rolls of manuscript by the poetess Sappho were also found. The discovery of a burial ground about two hours away from Cairo by rail revealed some 1,500 graves from which many interesting facts concerning the life of the Egyptians were gleaned. So, too, have many objects of value been discovered in Syria, Palestine, Asia Minor, Greece, Italy and Northern Europe. Systematic work in those lands will, no doubt, be continued in future years, and so new pages will be added in the stories of archaeology and anthropology (which see). M.S.

Related Subjects. While not all the references below to articles in these volumes relate to ancient lands, they are all of value to the student or reader:

Aztec	Osiris
Cave-Dwellers	Pompeii
Cliff-Dwellers	Pyramids
Herculaneum	Rosetta Stone
Mound Builders	Venus de Milo

EXCHANGE'. If you live in New York or Montreal and wish to pay a thousand dollars to a merchant in London or Paris you do not send him money. Instead, you buy at the bank a *bill of exchange,* a letter instructing a foreign banker to pay your creditor in English or in French money. According to the amount of gold in the national coins, £1 is worth $4.86⅔; one franc, 19⅓ cents. These amounts are known as the *par of exchange,* which means the normal rate; if you pay more, exchange is *at a premium;* if less, it is *at a discount.*

The rate of exchange between two countries is in general determined by the difference between the amounts which each is paying to the other. Thus, if on a certain day New York owes London £100,100, which at par is $487,152, and London owes New York only $486,665 (the equivalent of £100,000), the bank-

ers in the two cities can cancel each other's debts. New Yorkers will gladly pay $\frac{487,152}{486,665}$ of their obligations, or $4.87 for each pound bill of exchange, for it would cost them several cents to ship a pound of gold. On the other hand London bankers can sell bills at $\frac{486,665}{487,152}$ of the face value, accepting £1 for every $4.87. But if the difference between London's prospective payments and New York's is so great that $4.89½ is charged in New York for £1, some, as a rule, will find it cheaper to ship gold than to buy bills of exchange, while if the situation is reversed by London's debt becoming so much the greater that £1 will buy only $4.84, gold in normal times is shipped from England to America.

Exchange between two cities in one country is regulated by the same principles as foreign exchange. Thus, a check on New York will be accepted at par almost anywhere in the Eastern United States, but one drawn on a country bank will be discounted. The articles BANKS AND BANKING; CHECK, and BILL OF EXCHANGE contain further information about exchange.

EXCHEQUER, *eks chek'er,* CHANCELLOR OF THE, an officer who is in fact though not in name the treasurer of the British government. The law provides for a Lord High Treasurer and two junior lords of the treasury, but their positions are political rather than financial. It is the Chancellor who prepares the budget of expenses for the coming year and devises means of raising money for the government (see BUDGET). He must be a member of the House of Commons, and by virtue of his office holds a place in the Cabinet. His salary is £5,000 a year. The most famous of recent chancellors is David Lloyd George, who was succeeded by A. Bonar Law upon the elevation of the former to the post of Premier.

The word exchequer really means *chessboard,* and came to be applied to the Treasury Department because in earlier days accounts were figured and money counted on a checkered table, which was used like an abacus.

EXECUTIVE, *eg zek'u tiv,* or *ek sek'u tiv,* that governmental power of a country which is charged with the duty of enforcing the laws. The term includes the chief, or supreme, magistrate, to whom the sole governing power is confided, and is to be distinguished from the terms *legislative* and *judicial.* Under the United *States* government, the President is vested with this authority, and the governor of each state of the Union has in his hands the executive power of the state. The Governor-General is Canada's chief magistrate, while the emperor, king, queen or czar represents the executive authority, in theory, at least, in monarchies.

EXECUTOR, *eg zek'u ter,* or *ek sek'u ter,* in law, one appointed to carry out the provisions of a person's last will, and to act, after the testator's death, as his representative in all matters pertaining to his personal estate. Any person of twenty-one years, under no disability, such as unsound mind, may be an executor. One so named in a will may decline to serve, but once having undertaken the duty he cannot abandon it. An executor's duties are to probate the will, after qualifying for the position; to pay all bequests named in the will; to make an inventory of the personal estate and by sale to turn the surplus into money. He must keep separately all moneys of various funds, and where investments are made not directly specified in the will they are at the risk of the executor, and he must answer for any loss, unless he can show that he used due discretion. An executor must file an account with the probate court at the end of each year, should the administration be of long duration. His compensation is fixed by the court, and he is usually required by statute to give a bond for careful performance of duty; however, often by the terms of the will a bond is not required. Reasonable expenses are always allowed, and he is subject at all times to the direction of the court.

EXERCISE. See ATHLETICS; PHYSICAL CULTURE.

EX'ETER, the oldest continuously inhabited city in England, the county town of Devon, 173 miles southwest of London. It is a city of considerable beauty and is full of historic interest, but like all English cathedral cities, is quiet and lacking in enterprise. In the heart of a rich agricultural district, it has an important market but has no manufactures of importance. A canal connects it with the River Exe at Topsham, once one of the most important ports in England. Vessels of 400 tons come to the Exeter docks, alongside of which are large storehouses and caves cut in the cliffs for the storage of oils. Iron founding, the making of agricultural implements and the manufacture of paper are the most important industries.

The cathedral is a magnificent building with a finely decorated west front. Remains of the

ancient Norman castle of Rougemont are still seen on the hill of Northernhay, which has been made into a public park. Parts of the ancient wall of Athelstan still stand, and the Guild Hall, in High Street, is a picturesque building erected in the days of Elizabeth. Long before the Roman invasion Exeter was an important town and it has had a part in all the internal struggles of England. Under the Romans it was known as Isca Damnoniorum. Population in 1911, 48,660.

EXILE, *ek'sile,* is banishment from one's native country by order of the state, for a number of years or for life; or voluntary residence of a person in some foreign country with a determination never to return to his native land. If a man is in exile for a crime committed at home, he may be forced to return for punishment; for the law governing his enforced return, see EXTRADITION. Banishment was a more common mode of punishment among the ancient than among modern nations. Great Britain formerly transported convicts to colonies in Australia and Tasmania, and Russia continues to send political exiles to Siberia, but this form of punishment is being gradually abandoned by civilized nations. Today the most enlightened nations do not exile for any offense, but punish offenders by imprisonment. The use of a part of French Guiana as a penal colony cannot be termed a species of exile, for those sent there are guarded as prisoners.

EX'ODUS, the second book of the Bible, in which the departure of the Israelites from Egypt in search of the Promised Land is fully described. Although the story of this period in Jewish history, in which Moses led his people away from the land of bondage, is very interesting, most of this portion of the Scripture is filled with laws, covenants of God, ordinances of rites and ceremonies and specifications for the Tabernacle. Thus the constitutional history of Israel was made during the discipline of the thirty-eight years' wandering in the wilderness. The life of the Israelites in Egypt takes up the first twelve chapters in the book; their journey from Egypt to Mount Sinai fills the next six chapters, while the last twenty-two describe the events at Mount Sinai. In the books of *Leviticus* and *Numbers* the same narrative is continued, so some modern scholars group these three books together as one, calling it the *Exodus,* which means "a going out," or exit. It was from Mount Sinai, the great center during the law-giving period of Israel's history, that the law of the Ten Commandments was received (*Exodus* XX).

EXOTIC, *ex ot'ik,* a word from the Greek, meaning *foreign,* or *from the outside.* It is especially applied to plants which belong to a soil and climate different from that of the country to which they have been brought, and which must receive special care to be kept alive. Many of the plants in the warmest rooms of park conservatories are exotics, having been brought from tropical lands. Trying to raise such plants under any conditions other than those to which they have been accustomed would mean their death. Therefore, the word also signifies something rare or delicate, and is used in that sense in literature, referring to things other than plants.

EXPAN'SION, in physics, is the increase in the volume of a body resulting from an increase of temperature. The addition of heat increases the motion of the molecules, which are driven farther apart and so cause the body to become larger (see MOLECULE). Nearly all solids expand when heated and contract when cooled, a notable exception being rubber, which contracts when heated. The amount of expansion varies with the nature of the substance. The expansion of aluminum is twice that of iron at the same temperature, and that of brass is one and one-half times that of iron. Gases expand when heated and contract when cooled, the rate of expansion being practically the same for all gases, and greater than it is for liquids and solids.

Liquids expand when heated and contract when cooled to a certain temperature, after which any further lowering of the temperature causes expansion. In general the denser fluids expand less than the lighter ones. Water ceases to contract in cooling when it reaches a temperature of about 39° F. On cooling further it expands until the freezing point, 32° F., is passed. Below the freezing point, its expansion is about one-eleventh of its volume; this accounts for the bursting of pipes and other containers when water freezes in them.

The action of the thermometer (which see) is based upon the principles of expansion, and many industrial applications are made of the expansion of solids and gases. For example, carriage-makers put iron tires on their wheels while hot; these contract on cooling and so clasp the wheels more firmly. Railway-builders leave small spaces between the ends of the rails to allow for their expansion in summer. See HEAT.

EXPECTATION, *ex pek ta'shun,* in the common sense of the word, is a state of anticipating, or looking forward to some event. The term is used by insurance companies to denote the number of years persons may expect to live under ordinary conditions. Tables of mortality, as they are called, have been carefully compiled from years of observation and experience, and are used as guides in fixing insurance risks and costs.

The following table of mortality takes as a basis for calculation 100,000 persons at the age of ten years. Of the 100,000 it is estimated that 749 will die before reaching the age of ten.

Table of Mortality

Age.	No. living.	No. dying.	Exp't'n of life.	Age.	No. living.	No. dying.	Exp't'n of life.	Age.	No. living.	No. dying.	Exp't'n of life.
10.....	100,000	749	48.72	39.....	78,862	756	28.90	68.....	43,133	2,243	9.47
11.....	99,251	746	48.08	40.....	78,106	765	28.18	69.....	40,890	2,321	8.91
12.....	98,505	743	47.45	41.....	77,341	774	27.45	70.....	38,569	2,391	8.48
13.....	97,762	740	46.80	42.....	76,567	785	26.72	71.....	36,178	2,448	8.00
14.....	97,022	737	46.16	43.....	75,782	797	26.00	72.....	33,730	2,487	7.55
15.....	96,285	735	45.50	44.....	74,985	812	25.27	73.....	31,243	2,505	7.11
16.....	95,550	732	44.85	45.....	74,173	828	24.54	74.....	28,738	2,501	6.68
17.....	94,818	729	44.19	46.....	73,345	848	23.81	75.....	26,237	2,476	6.27
18.....	94,089	727	43.53	47.....	72,497	870	23.08	76.....	23,761	2,431	5.88
19.....	93,362	725	42.87	48.....	71,627	896	22.36	77.....	21,330	2,369	5.49
20.....	92,637	723	42.20	49.....	70,731	927	21.63	78.....	18,961	2,291	5.11
21.....	91,914	722	41.53	50.....	69,804	962	20.91	79.....	16,670	2,196	4.74
22.....	91,192	721	40.85	51.....	68,842	1,001	20.20	80.....	14,474	2,091	4.39
23.....	90,471	720	40.17	52.....	67,841	1,044	19.49	81.....	12,383	1,964	4.05
24.....	89,751	719	39.49	53.....	66,797	1,091	18.79	82.....	10,419	1,816	3.71
25.....	89,032	718	38.81	54.....	65,706	1,143	18.09	83.....	8,603	1,648	3.39
26.....	88,314	718	38.12	55.....	64,563	1,199	17.40	84.....	6,955	1,470	3.08
27.....	87,596	718	37.43	56.....	63,364	1,200	16.72	85.....	5,485	1,292	2.77
28.....	86,878	718	36.73	57.....	62,104	1,325	16.05	86.....	4,193	1,114	2.47
29.....	86,160	719	36.03	58.....	60,779	1,394	15.39	87.....	3,079	933	2.18
30.....	85,441	720	35.33	59.....	59,385	1,468	14.74	88.....	2,146	744	1.91
31.....	84,721	721	34.63	60.....	57,917	1,546	14.10	89.....	1,402	555	1.66
32.....	84,000	723	33.92	61.....	56,371	1,628	13.47	90.....	847	385	1.42
33.....	83,277	726	33.21	62.....	54,743	1,713	12.86	91.....	462	246	1.19
34.....	82,551	729	32.50	63.....	53,030	1,800	12.26	92.....	216	137	.98
35.....	81,822	732	31.78	64.....	51,230	1,889	11.67	93.....	79	58	.80
36.....	81,090	737	31.07	65.....	49,341	1,980	11.10	94.....	21	18	.64
37.....	80,353	742	30.35	66.....	47,361	2,070	10.54	95.....	3	3	.50
38.....	79,611	749	29.62	67.....	45,291	2,158	10.00				

At the age of fifteen 96,285 are still alive, and their expectation of life, based on the experience of thousands of others, should be 45.50 years. Five years later 92,637 are living, with probably 42.20 more years of life. At the age of twenty-five the number alive would be 89,032, and their estimated allotment of life 38.81 years. At thirty, 85,441 of the original 100,000 are left alive. Carrying the calculations out to the age of ninety, only 847 would be alive, and the limit of their expectation would be 1.42 years. The full table will be a matter of interesting study to every member of a family. It appears above.

EXPLORATION, *ex plo ra'shun.* See POLAR EXPLORATION.

EXPLOSIVES, *eks plo'sivz,* a variety of substances which explode when ignited or when struck or otherwise subjected to a sudden high pressure. The essential constituents of an explosive mixture are a combustible substance which in combustion yields gaseous products, and an oxidising agent. The force of the gases generated during the explosion is utilized for military and commercial purposes. The origin of the most familiar form of explosive, commonly called gunpowder, is not definitely known. Roger Bacon mentioned it about 1270, and Berthold Schwartz of Freiberg, Germany, described it about 1328. It was used by Edward I of England in his wars with Scotland. Some authorities claim that gunpowder was known to the Chinese centuries before it was discovered in Western countries, but of that there is no absolute proof.

Gunpowder. See the article GUNPOWDER.

More Modern Explosives. The increase of power in explosives effected by recent discoveries has necessitated improvements in guns and cannon, and for many years there has been a continuous race for effectiveness between explosives, guns and defense works. The discovery of guncotton by Schoenbein in 1845, and of nitroglycerine by Sobrero in 1847, put the science of explosives on an entirely new footing. In 1866 Nobel invented, or discovered, dynamite, which at once revolutionized all blasting operations. In 1886 Vieille produced the first really successful smokeless powder for military purposes. Nitroglycerine and guncotton still hold the field as the most effective for military purposes. All modern explosives

are directly or indirectly derived from nitric acid, one of the principal constituents of the saltpeter used in the original gunpowder. In general, the chemical compounds used as explosives are made by the action of a mixture of nitric and sulphuric acids upon non-explosive compounds, thus: picric acid is produced from carbolic acid; nitroglycerine from glycerine; guncotton from cellulose (cotton); trinitrotoluene from toluene.

Picric acid, also a product of nitric acid, is used as an explosive in the lyddite shells of the British army, and is deadly not only from the force of the explosion but on account of the fumes of the gases formed. Melinite, used by the French, is much the same in composition and effect. Trinitrotoluene is also much used as a high explosive for charging shells. Many experiments have been conducted in Germany with the object of producing explosives of greater power, but so far as is known nothing has been discovered to supersede guncotton and nitroglycerine. It is said that during the War of the Nations, before the end of 1915, the Germans were compelled by shortage of cotton to resort to wood pulp for the production of such explosives as had been previously dependent on guncotton. In that, however, they had been long anticipated, as Nobel in 1866 had used both wood pulp and fiber as a base for dynamite.

The manufacture of explosives is attended with considerable danger. In those consisting of chemical compounds the greatest care is necessary, especially in the preparation of the materials. For commercial purposes explosives are put up in various ways, the object being to render them as safe as possible to handle. Dynamite and blasting gelatin, with an average of more than thirteen times the power of gunpowder, are put up in "sticks" covered with paper. The sticks are usually about one inch in thickness and eight inches in length. The amount of dynamite used in blasts varies from half a stick to several thousands of pounds, according to the nature of the operations.

Related Subjects. The reader is referred to the following articles in these volumes, and to such other references as they suggest:

Ammunition	Guncotton
Artillery	Gunpowder
Carbolic Acid	Nitroglycerine
Dynamite	Picric Acid

EXPOSITION, *cks po zish'un,* INDUSTRIAL, an exhibition of large numbers of the products of industry and art. The great international expositions of the present decade, with thousands of exhibits from all parts of the world, are an outgrowth of the small local fairs which were common in Europe in the Middle Ages. These fairs were the earliest industrial exhibitions; the workers brought the products of their yearly or half-yearly labor to the markets for display and sale. Such gatherings seem originally to have had a religious character, but this was soon subordinated to the commercial. The fair at Saint Denis was held for the first time in A. D. 620, and that at Aix-la-Chapelle about 800. Such fairs are still common in various sections of Europe, but the most famous are those of Leipzig, especially for the trade in furs and books. The great fair at Nizhni Novgorod, held each year in July and August, is a notable event in the Russian Empire.

The modern industrial expositions have for their chief object the advertisement of products with a view to the ultimate increase in sales. Industrially, the modern exposition is a series of great sample-rooms, but along with the industrial features have developed other elements not of business character. Expositions now include displays of the fine arts, of educational material and of many things which are not intended to be sold. Above all, the visitors must be amused, and the so-called "concessions," or amusement stands, are now prominent features of all such enterprises. Most of the people who now visit expositions go not only as a matter of business, but they expect entertainment, as well.

Along with the attention to pleasure has come increasing regard for the architectural and landscape possibilities of a great exposition. The earliest buildings, like the Crystal Palace in London, were ugly structures of iron and glass. The buildings of the Centennial Exposition at Philadelphia were chiefly of iron, timber and glass. The first buildings of an entirely new kind were erected in Chicago for the World's Columbian Exposition in 1893. The framework was of timber and iron, but the exterior was a material called *staff,* a preparation composed largely of plaster of Paris. Being easily molded, this material permits artistic effects at small cost. The buildings are given a festive character, and the entire grounds have the appearance of a vast pleasure resort. Compared with wood or stone construction, staff is very cheap, but the material is perishable. In a few months, or at most a year, it cracks and begins to fall to pieces. Staff, however, serves all exhibition

purposes, for most buildings are torn down after the exposition closes. Nearly every exposition has left one permanent building or structure as a memorial. The Eiffel Tower and the magnificent Alexander III Bridge at Paris, the Memorial Art Gallery at Philadelphia, the German Building in Jackson Park, Chicago, and the Art Gallery at Saint Louis are monuments of past expositions. W.F.Z.

Related Subjects. The following expositions are given space in these volumes:

Alaska-Yukon-Pacific	Panama-Pacific
Centennial	International
Lewis and Clark	Pan-American
Louisiana Purchase	World's Columbian

EX POST FACTO. This phrase is Latin, and literally means *from something done afterward.* A law, for example, under which a man could be punished for a deed committed before the act was passed, is an *ex post facto* law. In its broadest sense the term applies to any law which changes the status of the past, that is, any law which is *retroactive,* making a deed a crime which was not a crime when committed. The Constitution of the United States expressly forbids the passage of *ex post facto* laws by the Congress.

EXPRESS COMPANY, an association or corporation which undertakes the transportation of small parcels and goods upon payment of fees. Such an enterprise is distinctly of American growth and has no counterpart in Europe, where the parcel post and railroads perform express services. In 1839 William F. Harnden advertised that he would undertake the transportation of small parcels and money between New York and Boston. His venture grew to large proportions and was copied by others, with the result that in a few years parcels and money could be sent to all parts of the United States, and eventually to many countries of the world, through express companies. Provisions for the issue and payment of money orders and the introduction of methods by which goods are paid for on delivery, still further increased the operations of express companies. Money orders and letters of credit issued by express companies are used by people abroad and prove of great convenience.

Express companies accept responsibility for loss or damage to articles they agree to carry, the amount of their liability being stated on the receipt handed to the shipper. In 1912 [redacted] estimated that the four largest of the [redacted]n express companies represented an [redacted]nt of more than $40,000,000, with gross receipts amounting to nearly $132,000,000 yearly.

The introduction of the parcel post (which see) January 1, 1913, by the United States government as a branch of the Postoffice Department, seriously affected the business of the express companies.

EXTEN'SION, in physics, is that property of matter by virtue of which it occupies space. Every material object, even the most minute, occupies a certain amount of space and has dimensions of length, breadth and thickness. A line having no breadth is imaginary; the thinnest sheet of paper has a certain thickness or it could not materially exist. The two units used in the measurement of extension are the English yard and the international meter. See PHYSICS; MATTER.

EXTERRITORIALITY, *ex ter ri to ri al' i ti.* If the ambassador from Russia drives an automobile in the streets of Washington at a speed of sixty miles an hour the police will not arrest him. In theory he is not in the United States at all, and is subject only to the laws of his own nation. If he persists in disregarding American regulations, the American government may request that he be called back to Russia, but so long as he remains in the United States he and all his family and his retinue are free to act as they please. This is an extreme illustration, but states a legal condition; as a matter of fact, diplomats scrupulously observe the laws of the country to which they are accredited.

This doctrine that certain persons carry their country with them wherever they go is called *exterritoriality.* It applies first of all to sovereigns, for of course no ruler could ever subject himself to the orders of a foreign power. Secondly, it concerns ambassadors and other diplomats; they are the personal representatives of sovereigns and derive a certain sacredness of character from traditions of heralds, who from prehistoric to modern times were able to come and go in enemy camps without harm. Thirdly, exterritoriality applies, with limits, to ships and armies of foreign governments; in this case immunity is a matter of courtesy, not of right, and a visiting ship or army must do nothing to violate the neutrality of its host. Last of all, the rights of exterritoriality are granted by treaty to citizens of the great powers by some of the non-Christian countries. Thus, British or American citizens in China or Turkey are tried by courts of their own countrymen.

EXTRACTS, *eks'trakts,* the name of substances obtained in many different ways from plants, vegetables, meats, flowers, etc. The best method for extracting the delicate perfumes from flowers is that of cold *enfleurage,* by which the flowers are placed upon pure, cold lard held upon glass plates in wooden frames. Every day fresh flowers are placed upon the lard, until it becomes saturated with their perfume. Then the lard is dissolved with cold alcohol, which in turn is evaporated, leaving simply the extract from the flowers. The essence of violets thus extracted is worth over $1,350 a pound. Other less expensive methods of extraction by steam, through petroleum-ether or melted lard are used extensively. Lemon, vanilla, and almond extracts, which are juices reduced to a proper consistency by evaporation, are used a great deal in cooking. Beef tea is the juice extracted from beef, with much of the water evaporated. Many extracts, containing alcohol as a solvent, such as those from digitalis, aloes, chamomile and licorice, are used extensively in medicine. Each of these is described in these volumes.

EXTRADITION, *eks tra dish'un,* from the Latin *ex,* meaning *from,* and *traditio,* meaning *handing over,* is the delivery of an alleged criminal by one nation to another, wherein the crime was committed. The process by which a criminal or fugitive from justice is returned from one state or province to another, in the same country, is called *requisition.* Between nations the matter is one of international law, and is decided by treaties. Nations decline generally to extradite political offenders and refuse to surrender citizens of their own country for foreign countries to prosecute on such charges. A man may be extradited from the United States only for a crime which is a felony (which see).

American Requisitions. Criminals are extradited, or, more properly, *requisitioned,* from one state of the Union to another, by executive action. An affidavit is first made before a magistrate charging the person with the crime. The governor of the state is then petitioned to request the governor of the state to which the accused has fled to deliver the prisoner for return and trial. The person suspected is held until the arrival of the proper authority to take him back. The state making the demand for the return of the criminal pays all costs connected with the arrest and surrender. A governor may, in his discretion, refuse to honor a requisition from another governor.

EYCK, *ike,* VAN, a Flemish family which in the fourteenth and fifteenth centuries gave three great painters to the world. These were Hubert van Eyck (1366-1426), Jan van Eyck (1390-1441), and their sister Margaret (? - 1431). For transparent and brilliant coloring and minute finish, the works of the two brothers have never been surpassed. They were the first to perfect the mode of mixing colors with oil or some medium in which oil is the chief ingredient; and by their method of painting with wet upon wet color they changed the entire traditional habits of the earlier schools of painting. The varnish they used prevented the paint from cracking and enabled them to perfect the full rich color still to be found in their works.

They were probably born at Alden Eyck, or Maas Eyck, on the Maas (Meuse). They first lived at Bruges, and the younger brother is sometimes called JOHN OF BRUGES. Later they moved to Ghent. At the time of Hubert's death he was engaged upon their masterpiece, the gilded altar-piece, having as its subject *The Adoration of the Lamb,* part of which is now in the Church of Saint Bavon in Ghent. This is the only work which can with certainty be assigned to Hubert; it was not finished at his death, but was completed by his brother in 1432. The two central of the twenty-four divisions of this picture are all that now remain in the church at Ghent, the wings being in the galleries of Berlin and Brussels; in its entirety it represented one of the world's art treasures.

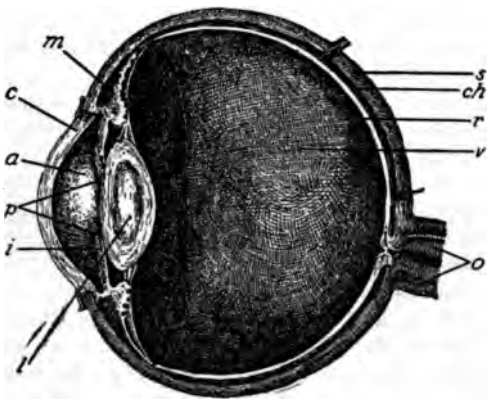
In the National Gallery, London, hang three portraits by Jan van Eyck; and in the Louvre, Paris, is his exquisitely finished picture of *Chancellor Rollin Kneeling before the Virgin.* Jan van Eyck also introduced improvements in linear and aërial perspective and in painting upon glass.

Margaret van Eyck is credited with some notable canvases, among which is a *Virgin and Child* in the National Gallery, London.

EYE, the organ of sight, is in many ways the most wonderful servant of the brain. One marvels at the great number of impressions the sense of sight alone may awaken. In reading a description of a battle, for example, one may *hear* the cannons roar, *feel* the pain of the wounded, and experience, to a certain degree, the thrills and emotions of the dreadful conflict. In the same sense the musician in scanning a sheet of music almost *hears* the written melody; while a person observing

another eating an orange or lemon feels that he actually *tastes* the fruit itself. Our first impressions of people are said to be, in great part, formed by what we see in their eyes.

Anatomy of the Eye. The eye is spoken of as a *ball,* or *globe;* accurately speaking, however, it is neither a globe nor a ball, since its vertical and transverse diameters measure slightly more than its anterior and posterior diameter, the former being approximately about one inch, the latter about nine-tenths of an inch. The eye is in reality a hollow ball filled with a *liquid,* a *solid,* and a *semi-solid*



CROSS SECTION OF THE EYE

(*a*) Aqueous humor
(*c*) Cornea
(*ch*) Choroid
(*i*) Iris
(*l*) Lens
(*m*) Ciliary muscle
(*o*) Optic nerve
(*p*) Pupil
(*r*) Retina
(*s*) Sclera
(*v*) Vitreous humor

body. The walls forming the ball are arranged in several layers, which are superimposed. The *outer* wall, or layer, is made up of two tissues which merge into one another. The posterior five-sixths of this wall is formed by a firm fibrous tissue called the *sclerotic,* which one sees as the *white* of the eye. It gives form and protection to the ball. Joining the sclerotic in front, and forming the remaining sixth, is a transparent portion, the *cornea,* which projects from the sclerotic as a watch crystal projects from a watch. The cornea is really the window of the eye. Within the sclerotic is another layer, the *choroid,* made up principally of blood vessels which are the chief source of nourishment for the tissues of the eyeball. This layer, as it runs forward, merges into another tissue, the *ciliary body,* and this in turn merges into the *iris.* The ciliary body contains the muscle used in focusing the eye, and to it also are attached the ligaments which hold the lens in position. The iris is perforated at about its center, forming the black spot, or *pupil.* By means of muscles in the iris substance, the pupil can be made to dilate or contract—grow smaller or larger—and in this way the amount of light permitted to enter the eye is regulated. The iris is variously colored in different individuals, forming the blue, brown or gray eyes, etc., the colors depending upon the amount and general distribution of pigment in the iris substance. A large number of infants at birth are blue-eyed. In many, however, after some weeks have passed the color of the iris changes, owing to the development of the iris pigment, and the eye becomes darker. In albinos the iris, in common with the hair and skin, has no pigment, which permits a reflection of the deeper blood vessels in the interior of the eye to be seen, causing such eyes to present a pink appearance.

Within the choroid lies the inner layer, the *retina.* This layer is formed by the special nerve of sight, the *optic nerve,* which, after leaving the brain, directs its course to the back of the eyeball, which it penetrates, and on reaching the level of the choroid spreads out on its surface as a nerve carpet or screen, forming the retina. The point at which the optic nerve enters the eyeball is known as the *blind spot* (Mariotte's), so that it is a curious fact that each eye contains a small area which is blind. Another small area in the retina of each eye, called the *macula* (*macula lutea*—yellow spot), is the area where vision is most distinct. On the interior of the eyeball, immediately behind the cornea and in front of the iris and pupil, is a space called the *anterior chamber,* which is filled with a liquid

DIAGRAM FOR EXPERIMENT

The above illustration can be used to prove the existence of a blind spot in the eye. Close the left eye; look squarely at the white cross. Move the page varying distances from the eye; at one point the right side of the drawing will become entirely black, the white spot disappearing. The explanation is that the white spot has come into a direct line with the blind spot.

called the *aqueous humor.* Just back of the iris is a double-convex, transparent, solid body, the *crystalline lens,* which is the essential structure in the function of accommodation, and is also the structure in which the disease known as *cataract* develops. Behind the lens is a large cavity, the *vitreous chamber,* filled

with the *vitreous humor,* a substance somewhat of the consistency of thin jelly. The eyeball itself is in great part enclosed in a membranous sac, the *capsule.* The anterior portion of the sclerotic is also covered by a delicate membrane, the *conjunctiva,* which is reflected from the sclerotic to the inner surface of the lids.

The eyeball rests in a bony cavity called the *socket,* or *orbit,* upon a cushion of fat which protects it from jars or shocks. It has attached to it at various points muscles which move it in the different directions. A gland, the *lachrymal,* is located under the upper lid at its outer portion, and this manufactures the tears. A number of pipe lines or ducts lead from this gland and open on the inner surface of the upper lid. During the act of winking these ducts are squeezed, and in this way the delicate cornea of the eye is sprayed with the tears, and its surface kept moist and brilliant. The tears are carried away partly by evaporation and partly by drainage canals located at the inner corner of the eye, one on the margin of each lid, which lead by a duct or channel into the lower portion of the interior of the nose.

The lids are formed of loose tissue, embedded in which are plates of stiff material called *tarsal cartilages,* which give them form and firmness. The upper lid is very movable; the lower lid moves but little. The eyelashes are inserted in the margin of each lid, those of the upper curving upward, those of the lower downward, in order that they may not interlace when the eye is closed. The opening between the lids is called the *commissure.* A large or small eye depends not upon the size of the eyeball itself, but upon the width and breadth of this *commissure* which permits a greater or less amount of the eyeball to be seen. The eyelids and eyelashes are a great protection to the eye; they safeguard it from flying bodies, dust and wind, shade it from the light, and by the act of winking sweep it of dust and distribute the tears and keep its surface moist. The *eyebrows* shade the eyes and prevent dust and perspiration from entering them.

How We See. Light is a form of energy caused by vibration of the ether. It eminates from a luminous body as waves, called *rays.* When an object is seen, the rays of light from this object strike first the cornea of the eye, then pass through it and through the anterior chamber, pupil, lens and vitreous humor. These media, as they are called, refract, or bend, the rays to such a degree that they are all collected into a small point, and come finally to a focus or meeting place on the retina, which is the receiving nerve screen of the eye. The different rays from the object really form upon the retina a miniature picture of the object looked at, and this picture is relayed to the optic nerve, which in turn carries it to the center of sight in the brain, where it is finally interpreted as the picture of the object itself. Each eye conveys a separate picture of the object looked at to the sight centers in the brain, and these pictures are inverted, or upside down. In the sight centers, however, by a process little understood, the two pictures are fused or merged into *one single, distinct image of the object looked at,* and the inverted position is corrected; so through these agencies the final result of the visual act is that in normal eyes only one object is seen, and this in its correct, upright position.

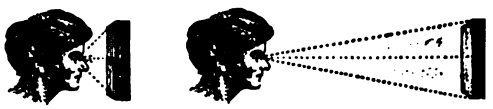
Accommodation. If you look at something very near to your eye, objects at a distance then become indistinct; if, on the other hand, you gaze at something far away, objects close at hand become hazy. This is so because no lens can focus on the same screen at the same instant rays of light coming from a near object and rays of light coming from a distant one. In order that a clear, well-defined, distinct picture of an object be seen it is necessary that the rays of light coming from this object be brought to a definite, precise focus on the retina and that all other objects not within this particular distance be more or less excluded from consideration.

In a camera the adaptation, or focusing, for near and distant objects is brought about by moving the lens of the camera forward and backward the appropriate distance. In the human eye, however, it is not possible to alter in this way the distance by moving the lens of the eye backward and forward, but the adjustment is brought about by the human lens changing its shape or curvature to suit the varying distances. This function of the lens is designated as that of *accommodation,* and is brought about by a highly-complex nerve-muscle impulse-adjustment.

We Cannot Always Believe What We See. In spite of the wonderful structure of our eyes they would be untrustworthy if *intelligence* were not applied to correct their mistakes. Are the things we see outside of our eyes or

inside of them? We are so used to thinking that they are outside that it is hard to realize that what we see is not the world outside of us, but the pictures of it on our retina formed by the vibrations of light. A person who has been blind all his life and suddenly is given sight is conscious that the picture he sees is inside his head, and thinks all the objects in it are close to him. He has to learn from experience, as we did when we were small children, to judge of such matters as distance and motion.

Why do the earth and sky seem to meet, and the rails of a car track to come together in the distance? If you hold this book about five inches from your eye, the rays from the top and the bottom of it will meet at right angles on the cornea, and the image of the book will occupy nearly the whole of the retina. If you hold it farther away, as in the



Explanation of illustration will be found in the accompanying text.

illustration, the rays from the top and bottom will be closer to the rays from the center, and if you had neither intelligence or experience you would say the book is smaller. Thus as you look at a railroad track the rays from rails near you enter the eye at an angle and are *refracted* to the edges of the retina. But the farther away a rail is, the closer are the rays from it to those from the center of the track. The rays from the very distant rails occupy the same spot on the retina as the rays from the center, and our eyes tell us that the rails have met.

Why the Wheel of a Moving Automobile Appears Solid. The impression made on the retina by each light wave lasts from one-fiftieth to one-thirtieth of a second. If a wheel is revolving rapidly, we get a new picture of each spoke before the old one has disappeared; thus the image of the spoke is in several places on our retina at the same time. This is the principle upon which moving pictures depend, but in order to prevent their being an indistinct blur, like the automobile spokes, each picture rests an instant as it comes before the eye.

Defects of the Human Eye. Sight is made up of a combination of three sub-senses, namely, sense of *light,* sense of *form* and sense of *color.* The *light sense* enables us to appreciate the varying intensities of light; the *form sense* conveys information as to the shape of an object; the *color sense* distinguishes the color. All eyes are not normal—from an optical or other standpoint. The great majority present some defects, varying in degree and character, which are commonly spoken of as long- or short-sightedness, old sight, astigmatism, color blindness and cross-eyes.

Care of the Eyes. We learn from a paragraph above that the lens of the eye accommodates itself to our varying needs by changing its shape when we wish to look at an object near at hand or one at a distance. Now the nerves and muscles that cause the lens so to adjust itself become very tired if overworked, and when badly abused we suffer from what is called *eye strain.* The habit of reading in a poor or fading light is a very common cause of eye strain. Reading while traveling on a jolting train is very injurious, because the distance of the book from the eyes is constantly changing, and the muscles must work overtime to keep the lens in adjustment. A pernicious practice also is that of reading while lying in bed or while ill. Reading in these positions imposes great strain upon the eyes, and if one be ill, in addition, the general lowered muscle and nerve tone associated with the illness is shared by the eyes, and abuse of them at such times is distinctly injurious. Many serious diseases of the eye result from the practice of permitting untrained persons to attempt the removal of dust, cinders, etc., from the eyes. This practice should be condemned vigorously.

It would prove a profitable and wise custom if individuals contemplating entering a profession or occupation requiring great demands upon the eyes would in advance determine if their eyes are suited to the work about to be assumed. Such forethought would often spare the sad disappointments and hardships which a later development of inadequate or troublesome vision inflicts.

The majority of eye diseases are caused by germs which are communicated to the eye through the medium of unclean hands, soiled linens or other media. One cannot be too careful about what touches this delicate and priceless organ. Never dry the face with a towel that is hung in a public wash room—the uncivilized "roller towel," for example—for it may harbor in its meshes countless germs of diseases which may be communicated to the

eyes during the act of drying the hands or face. It should be remembered that many diseases, like measles, grip and diphtheria, frequently involve the eyes during their course, and on the first evidence of eye symptoms the physician or oculist should be consulted. An uncompromising rule should be that an eye discharging pus or matter is a dangerous eye, dangerous to its owner and to everyone with whom he comes in contact, and therefore should not be neglected but should receive immediate attention.

Another rule of equal importance is that one should never neglect even trivial conditions of the eyes. They are exceedingly delicate organs, and their value to the individual for his happiness and comfort is probably unequalled by any other organ of the body. Early attention to all defects by a competent oculist should be the watchword. Suitable glasses should be worn, if required, and the proper glass should always be worn when automobiling or when the eyes are exposed to intense light. Dentists and workmen engaged in occupations where flying particles are common should wear protective spectacles. Wearing of veils with thick-figured meshes should not be practiced, as such a custom tends to develop eye strain.

The eyes of infants require special care and safeguarding. They should not be exposed to bright light, and the shades of their little carriages should be of dark-colored material, which effectually shades them from the light. In its early years the child should not be permitted to use the eyes for prolonged periods, looking at picture books, printed matter, etc., or engage in close or near eye work for any considerable length of time, for during their formative periods children are very likely to develop eye strain or other serious eye defects. Outdoor enjoyments for growing children are as desirable from an eye standpoint as from that of general health. R.J.T.

Related Subjects. The reader is referred to the following articles in these volumes:

Astigmatism	Cataract
Blindness, with subheads on *Diseases*	Color Blindness
	Senses, Special

EZEKIEL, *e ze'ki el,* a Jewish prophet who was carried away with his people as a captive by Nebuchadnezzar, when the latter took Jerusalem in 597 B.C. He lived near the river Chebar in Babylonia, was brought up under the ministry of Jeremiah, the prophet, and began his work when he was thirty years old, continuing it for twenty-two years. The time and manner of his death are unknown. The book in the Old Testament known by his name is filled with his prophecies, arranged nearly in the order in which he delivered them. They abound in figures of speech and symbols referring to customs of his time, which are unknown to-day. He is known as one of the four great prophets, the others being Jeremiah, Isaiah and Daniel, and is known especially as the prophet of the Captivity.

EZ'RA, a Jewish scribe and high priest whom Artaxerxes, the king of Persia, sent to Jerusalem to investigate the civil and religious condition of the Jewish community in 458 B.C. Accompanied by 1,500 other Jewish exiles, whom he was permitted to lead back to Palestine, he arrived at his destination four months after he left Babylon. He was much amazed to find that many Jews had married heathen wives, but he soon brought them back to the observance of the Mosaic law. Thirteen years later, when Nehemiah came to Jerusalem, Ezra took a leading part in reading the law of Moses to the colony and did much important work in preserving and circulating the sacred books. He marks a transition from the prophets to the scribes, and was, in a sense, the forerunner of the rabbis who played so important a part in the later Jewish life and religion. Some Bible students believe that Ezra was the author of the Pentateuch, but the evidence is inconclusive.

The Book of Ezra once included the book of Nehemiah, but it is now a separate book of the Old Testament. It is filled with public records and documents which were copies of letters sent to Persian kings by officials of his provinces. There are two parts to the book; the first deals with the return of the Jews to Babylon in 538 B.C.; the second tells how Ezra led the exiles home eighty years later.

Ff

F. Exactly how the sixth letter of our alphabet developed from the bent nail *vau,* which held the same place in the Phoenician alphabet, no one knows. The Greek *gamma* (Γ, γ) was doubtless the same character, though pronounced differently, and the ancient Greek *digamma,* or *double gamma,* was written Ϝ, but was probably sounded like our *w.* Strangely enough, our numeral *6* is a survival of *digamma.*

In music *F* is the fourth note in the natural scale of C.

FABIUS, *fa'bi us,* the family name of several of ancient Rome's most famous men.

Quintus Fabius Maximus Rullianus, a successful general, was probably the first of the line to be called Maximus, or *The Very Great.* This honor he earned in 304 B.C. by excluding freedmen from all but the four city tribes, thus giving the aristocracy control of the *comitia* (which see).

Quintus Fabius Maximus Cunctator was the true Maximus of the Fabian gens. His name, *Cunctator,* or *Delayer,* he gained by his tactics when, as dictator, he opposed the hordes of Hannibal in 217 B.C., constantly harassing the Carthaginian's provision trains and advance and rear guards, but always refusing to give battle. George Washington has been called *The American Fabius,* because he, too, won battles by not fighting them.

Caius Fabius Pictor, as his last name shows, was a painter, and in 302 B.C. made the first Roman paintings of which we know.

Quintus Fabius Pictor, grandson of the painter, wrote the first prose history of Rome.

FABLE, *fa'b'l.* This word, from the Latin *fabula,* means literally any *story,* but is commonly used to describe a very special kind of narrative—a short story which is told not just for its own sake, but to point a moral. Usually the characters are animals or inanimate objects, but these are gifted with all the traits of character and the powers of human beings, and their wisdom or folly teach useful lessons. The point of the lesson is not left to chance, but it is clearly stated at the end in a single outstanding sentence, labeled *Moral.* Here, for instance, is a typical fable by Aesop, in true fable form:

The Fox and the Grapes

A hungry fox once saw some fine, luscious grapes hanging temptingly from a vine a few feet above his head. He leaped and snapped and leaped again, but never could he quite reach the grapes. So many times did he try that he tired himself out completely, and it was some time before he could drag himself limping away. As he went along he grumbled savagely to himself, "What nasty things those grapes are! No gentleman would eat a thing so sour."

Moral: Every man tries to convince himself that the thing he cannot have is no good.

This fable, written centuries ago, is to-day a part of the life and thought of civilized people everywhere. If a man sees another man pretending to scorn a certain really desirable thing he might say, "He's trying to make himself and us believe he doesn't want it, just because he can't have it"; but that would be a cumbersome, heavy way of expressing his meaning. What he does say, with a sly smile, is, "Sour grapes!" and everyone knows what he means.

What, then, is the difference between a *fable* and a *parable,* which may also be described as a short story told not for its own sake but to illustrate a truth? It lies in one very definite point: a parable never bestows on animals or things powers and characteristics which they

do not really possess. For instance, in one of the best known of all, the Biblical parable of the lost sheep, it is not the sheep which speaks. If this were a fable the sheep would have the power of speech, and would tell how it had suffered for wandering from the fold, and how the shepherd, leaving the ninety and nine in safety, followed it through all its dangers until he bore it back to safety.

The earliest fables were written in India, for the Oriental mind appears to have a peculiar faculty for expressing itself by such indirect means, and it seems certain that the best-known fables in all the world, those famous ones called *Aesop's Fables* (which see), were founded on these early Hindu tales. Later writers have tried to imitate these simple, perfect stories, but few have succeeded. Horace produced one, the *Town Mouse and Country Mouse,* which is fit to rank with Aesop's *Hare and Tortoise, Fox and Grapes, Lion and Mouse, Fox and Crow* and other classics; and Lafontaine, a French writer of the seventeenth century, published a series of *Fables* in verse which are by far the most famous of all modern writings of this sort, and are learned by every French school child. He gave in four short lines the reason for the popularity and effectiveness of fables:

Fables in sooth are not what they appear;
Our moralists are mice, and such small deer.
We yawn at sermons, but we gladly turn
To moral tales, and so, amused, we learn.

Many of Andersen's best-loved tales, as *The Ugly Duckling, The Hardy Tin Soldier, The Darning Needle, The Snow Queen,* are fables of a sort, in that they teach lessons through stories, but they have far more complicated happenings and a much greater wealth of detail than has the typical fable. The same may be said of Harris's *Uncle Remus* stories and of Kipling's *Jungle Books,* which possess many of the characteristics of fables. A.MC C.

FAÇADE, *fa sahd',* the front of a building, but particularly the principal front, or the *face.* Unlike a person, a building may have a number of faces. As a rule, though, there is one *façade* more important than the others. In cross-shaped churches, for instance, there are usually north, south and west façades, of which the last is the largest and most prominent. A *screen* façade is one which is broader and higher than the building behind it.

FACE, THE. No other portion of the human body is in itself quite so intimate a part of the personality as the part we call the *face.* Every normal person comes into the world with a forehead, two eyes, a nose, a mouth, a pair of cheeks and a chin, which together comprise the face, but there is a different combination for each individual, and because of this variety in the human countenance we learn to recognize our fellow beings and to tell them apart. While the term *beauty,* in connection with the body, includes many other factors, it refers primarily to the face; we consider our friends beautiful when they have a pleasing combination of features, eyes and complexion. Through the face, too, is expressed much of what goes on in the mind. There is a circular muscle surrounding the mouth, and one around each eye, while other muscles radiate from the edges of these. By means of the face muscles we express all our varied emotions—joy, grief, despair, contempt and a host of other feelings. An American poet of the nineteenth century, Abraham Coles, has expressed this thought in these words:

Unmatched by Art, upon this wondrous scroll
Portrayed are all the secrets of the soul.

The skeleton of the face, exclusive of the thirty-two teeth, consists of fourteen bones. All but two of these, the lower jawbone (*mandible*) and the *vomer,* which separates the nostrils, occur in pairs. The two bones of the upper jaw form most of the hard palate in the roof of the mouth. The two *palate* bones, which complete the hard palate, lie in front of the opening through which air passes into the throat cavity from the nasal chambers. The cheek bones are the two *malars.* Forming the bridge of the nose are the two *nasal* bones, while the *lachrymal,* or *tear* bones, lie between the eye sockets and the nose. Finally, there are two *turbinate,* or spongy, bones, which form the outer wall of the nostrils. Of all these bones only the lower jaw is movable. See SKELETON; also HEAD, for illustration of the bones named above.

FAC'TORING, the process of separating a number into the quantities which, when multiplied together, will produce it. The integral numbers which, multiplied together, produce that number, are called its *factors.* Every number is the product of itself and 1, and so has itself and 1 as factors; for example, $6\times1=6$; $19\times1=19$.

$$6\times7=42$$
$$3\times6=18$$
$$4\times9\times2=72$$

6 and 7 are factors of 42; 3 and 6 are factors of 18; 4, 9 and 2 are factors of 72. Each of

these three numbers has other factors; for example, 2 and 21 are factors of 42; 2 and 9 are factors of 18; 3, 8 and 3 are factors of 72.

A number that has no factors except itself and 1 is a *prime number,* as 19, 3, 37, 2, 101.

A prime number used as a factor is a *prime factor;* for example, in $3\times7=21$, 3 and 7 are prime factors of 21; in $5\times7\times23=805$, 5, 7 and 23 are prime factors of 805.

A number that has factors besides itself and 1 is a *composite number;* for example, 4, 9, 25, 150.

A composite number used as a factor is a *composite factor;* as, $4\times9=36$. 4 and 9 are composite factors of 36. $4\times25=100$. 4 and 25 are composite factors of 100.

A factor of a number will divide the number exactly (without a remainder) and so is called a *divisor* of the number. $3\times7=21$. 3 and 7 are factors of 21. $21\div3=7$; $21\div7=3$. They are also divisors of it.

Exercises. (1) Name all the prime numbers from 1 to 100. How can you tell which of these numbers are prime? (See DIVISIBILITY OF NUMBERS, and study it in connection with factoring.)

(2) Using the "tests for divisibility," tell by what numbers from 2 to 11, inclusive, each of the following is divisible:

84	384	402
81	561	1168
27	9729	7986
75	37800	105

(3) Tell which of the following numbers are prime and which composite:

26	441	88	3069
18	79	41	671
59	111	171	407
38	119	67	729
66	167	57	1023

Separation of a Number into Prime Factors. (1) Let us separate 72 into its prime factors.

(a) $72=8\times9$
(b) $72=(2\times2\times2)\times(3\times3)$
(c) $72=2\times2\times2\times3\times3$

In (a) 72 is separated into two composite factors, 8 and 9. In (b) these factors are separated into their prime factors, and we have the prime factors of 72. In (c) the parentheses are dropped; (c) may be written in another form, which is very convenient, by using the exponent, thus: $72=2^3\times3^2$. The exponent *3* tells how many times 2 is used as a factor in 72, and the exponent *2* tells how many times 3 is used as a factor in 72.

(2) We shall factor 81, showing the steps as ıve.

$81=9^2$
$81=9\times9$
$81=(3\times3)\times(3\times3)$
$81=3\times3\times3\times3$
$81=3^4$

The exponent *4* shows that 3 is used as a factor 4 times in 81.

(3) Factor 144.

$144=12^2$
$144=2\times6\times2\times6$
$144=2\times3\times2\times2\times3\times2$
$144=2^4\times3^2$

Another method of finding the prime factors of a number follows:

(4) Find the prime factors of 1365. 1365 is divisible by 5, since it ends in 5. Divide, and we see that $1365=5\times273$. 273 is divisible by 3, since the sum of its digits is divisible by 3. Divide, and we find that $1365=5\times3\times91$. Dividing 91 by 7, we find $1365=5\times3\times7\times13$. A more concise form is this:

$5\overline{)1365}$
$3\overline{)273}$
$7\overline{)91}$
13

These steps may be summarized as follows:

(1) Separate the number into any of its composite factors and then separate these factors into their prime factors, as in (1), (2) and (3) above.

(2) Divide the number by one of its prime factors; then divide the quotient obtained by one of its prime factors; continue this process until the quotient is a prime number. The divisors and the last quotient are the prime factors of the number, as in (4) above.

Common Factor. A factor that occurs in each of two or more numbers is called a *common factor* of the several numbers; for example, 8 is a factor common to 16, 24, 48, 72; 7 is common to 28, 56, 105. A common factor is called also a *common divisor* and a *common measure,* because it divides each number exactly, and with it as a measure we may evaluate and compare the several numbers; for example, 7 is a common measure of 35, 42, 84 and 21. 35 is 5 sevens, 42 is 6 sevens, 84 is 12 sevens and 21 is 3 sevens.

Greatest Common Factor. The largest factor or divisor which is found in each of two or more numbers is called the *greatest common factor,* the *greatest common divisor,* and the *greatest common measure* of the several numbers. For example, 24 is the largest factor found in 48, 72 and 96. Therefore 24 is the greatest common factor, the greatest common divisor and the greatest common measure of 48, 72 and 96.

Numbers Prime to Each Other. 16 and 45 have no common factor other than 1; 25 and

36 have no common factor except 1. When numbers have no common factors other than 1, they are said to be *prime to each other*. For full discussion of greatest common divisor see the article of that name. For full discussion of multiples, see LEAST COMMON MULTIPLE. See, also, for closely-related subjects, FRACTIONS; SQUARE ROOT; CUBE ROOT. A.H.

FACTORY AND FACTORY SYSTEM. The word *factory* suggests great buildings in which hundreds of men, women and perhaps children are engaged in making thousands of articles. The factory is typical of modern industry; it is the application of economic law to the process of production. By division of labor a large number of workmen coöperate to make at a lower cost many times more articles than the same number of workmen could make if each worked separately. Strictly considered, a dozen men, working in the same building and each making a complete pair of shoes a day, would not be workmen in a factory. But their shop would be a factory if these twelve men worked in coöperation, and if each man performed only a few of the processes, with the result that not one dozen pairs but many dozen pairs were finished each day. The essential feature of the factory system is not the number of workmen, or the use of machinery, or the increased output, but it is the division of labor. Any establishment in which a number of persons *coöperate by consecutive processes* in the production of an article may be called a factory.

Development of the Factory System. The factory system did not suddenly spring up, fully developed, but it grew by degrees. It arose about the middle of the eighteenth century, when new inventions were beginning to take the place of hand labor—about the time that Arkwright's and Hargreaves' spinning jennies, Cartwright's power loom and other inventions revolutionized the manufacture of cotton goods. The introduction of automatic machinery was accompanied by the persecution which all pioneers must face; many inventors, a few now famous and many lost in obscurity, spent years in perfecting machines only to have them destroyed by mobs. Some people thought that machinery was the work of Satan, and others thought that it would throw all workmen out of employment.

These two types of opponents could not stop the growth of the factory system, and during the nineteenth century its development, not only in Great Britain and America, but throughout the civilized world, made it possible for the inventor to protect his own interests as well as benefit his fellows. The patent system stimulated invention, for the man of ideas could then be sure that his neighbor could not steal his plans without punishment. Inventions were soon recorded in all branches of industry.

Besides the introduction of automatic machinery and the development of the patent laws, the factory system owes its growth to two factors—the use of steam as motive power and the development of transportation facilities. At first all machinery was driven by water power. This meant that a factory had to be placed at some spot where there was sufficient water power, regardless of location with reference to the markets or labor supply. When, however, steam power became available, the factory owner could locate his plant wherever the supply of workmen and the demand for his products seemed to make a factory most desirable.

Even with this restriction on location removed, the factory system could not have reached its greatest development with the slow and costly methods of transportation used in the eighteenth century. The use of steam power in manufacturing freed the manufacturer from the restriction of location, but the application of steam to railroads and ships did more, for wherever he might be, it opened to him the markets of the world. To be sure, nations sometimes restrict markets by impos-

ing tariffs, or even by going to war, but under normal conditions the manufacturer in any country may compete wherever it pleases him to do so.

Benefits and Evils of the Factory System. The benefits of the factory system have been enormous. The old argument that the introduction of machinery would be followed by lack of work and poverty has long since been disproved. It is now admitted that the factory system merely diverts labor to the most profitable channels. A factory-made shoe, finished in twenty minutes, will wear as well as a hand-made shoe which the individual shoemaker makes in one day. A factory-made watch, finished in a few hours, keeps as good time as a Swiss hand-made watch finished in nearly as many weeks. The Swiss watchmaker, moreover, gave the best years of his life to an apprenticeship which is no longer necessary. As a general rule the division of labor has resulted in a vast improvement in the quality of the article, in a great saving of time, and consequently, in a reduction in the cost of manufacture. Lower cost means lower prices, which in turn have increased the demand for labor, and the increased demand for labor has been followed by higher wages and a higher standard of living. While there are sections or industries in which these facts may not always be apparent, they cannot be questioned if the effect upon the civilized world is considered as a whole.

That the factory system has its evils is also true, but their importance is easily exaggerated. Women and children have doubtless been employed in greater numbers under the factory system than ever before; but their employment did not begin with the factory, and in many respects the conditions of work are better in the factory than outside of it. Unsanitary conditions do exist in some factories, but they are not to be compared with the wretchedness of sweat-shops or tenement homes. It is true that by regulating the speed of machinery the work-pace may be forced so that the factory wears out the workman at a comparatively early age—perhaps forty-five or fifty years is the average in most trades—but on the other hand the factory provides better pay and shorter hours of work. It has made possible a higher standard of living, under which the laborer has more time for recreation and self-improvement. In some respects the minute division of labor permits the use of lower order of intelligence, since the workman need understand only one step in a complicated process; but, on the other hand, by associating with other workmen the individual acquires new ideas and a broader outlook on life.

No further evidence of these facts is needed than the success of labor organizations in securing better working conditions for their members and their constant struggles for still higher standards. Perhaps the most conspicuous result of the factory system has been the widening gulf between labor and capital; at one extreme are the powerful labor organizations, at the other extreme are the great combinations of capital in production.

Related Subjects. The reader is referred to the following articles in these volumes:

Invention	Labor Organizations
Labor, Division of	Patent
Labor Legislation	Trusts

FAHRENHEIT, *fah'ren hite,* GABRIEL DANIEL (1686-1736), a German scientist, ranking high in the realm of physics and famous as the inventor of the thermometer scale that bears his name. He was born in Danzig, Germany, but lived for some years in Holland and England, making his living by the manufacture of meteorological instruments. He was the first to employ mercury instead of alcohol in thermometer tubes, thus greatly adding to the accuracy of the instrument. He was elected a member of the Royal Society of London in 1724. See THERMOMETER.

FAÏENCE, *fa yahNs',* a soft-bodied, glazed pottery first made by the Italians at Faenza, from which it received its name. The French learned the method and improved upon it, until a very beautiful ware was produced in the sixteenth, seventeenth and eighteenth centuries. It became very popular, and during the wars of the reign of Louis XIV, when all silverware was being sent to the mint, faïence sets were made for the royal palace and the nobles at court. Josiah Wedgwood, whose wares are now so famous, started a faïence factory in England in 1763. The Rookwood pottery, made in Cincinnati, O., is faïence of a high order; its decoration is unusually beautiful. See WEDGWOOD WARE; ROOKWOOD POTTERY.

FAINT'ING, or SYNCOPE, *syng'ko pe,* is loss of consciousness and of power to move and to feel. The face of a fainting person becomes pale, the breathing process is for the time being suspended, and the pulse at the wrist ceases to beat. There is such complete loss of muscular power that a person who

faints while standing always falls to the ground. Fainting is caused by the temporary checking of the action of the heart, as a result of which too little blood is sent to the brain. This failure of the heart to act may be due to a variety of causes—exhaustion, loss of blood, pain, fright, excessive grief, shock, etc. It is sometimes a result of organic heart trouble, and it may occur with other diseases.

In all cases of fainting the patient should be placed on his back, with the head and chest lower than the rest of the body, so the blood may flow more easily to the brain. The clothing should be loosened to permit freedom of breathing and of circulation. Cold water may be thrown on the face to stimulate the nerves which hasten the action of the heart, but in case of a protracted faint it is often necessary to administer stimulants hypodermically. Such cases require a physician. W.A.E.

FAIR, *fare.* It is so easy nowadays to visit the grocery store or telephone to the grocer, that we forget that our ancestors—perhaps our very fathers and grandfathers—had to purchase months' or even a year's supply of provisions at one time. Until the railroad and the steamboat began to serve the world it was impossible to distribute the products of all the industries as they are distributed to-day, in a continuous flow from producer to consumer. Thus it was that back in the days of the Roman Empire men began to hold fairs, periodical gatherings of merchants to which the people could come to collect supplies. As time went on the importance of fairs increased and during the Middle Ages thousands of them were chartered. Often such charters were granted to churches or to monasteries, and the fairs were held on religious festivals.

Fairs to-day are of many sorts. In America the most common is the agricultural fair, discussed in the article EXPOSITIONS, INDUSTRIAL. Church fairs, or bazaars, are obviously survivals of the medieval fair, and so, too, is the *kermis* (the word means *church mass*) of Holland and Brittany. In Europe there are a number of great fairs which still maintain their medieval character. The annual gathering at Nizhni Novgorod in Russia draws merchants and purchasers from all Europe and Western Asia.

FAIR'BANKS, the largest city of Alaska. It is the seat of the Fourth Judicial District, which comprises all the interior of the territory, and is situated just half way between the north and south coasts. It is on the Tanana River, a branch of the Yukon, and during the five open months of summer has steamboat connection with Saint Michaels, near the mouth of the Yukon, and with Dawson and other points on the Upper Yukon. In the past the approach by land has been by stage from Valdez, on the south coast, but Fairbanks, as shown by the special map in the article ALASKA, is now on the route of the new government railroad, 471 miles north of Seward. An older railroad runs from Fairbanks forty-five miles into the gold fields, and it is probable that the government will some day extend its system to the Yukon. In spite of its isolation and its small population (3,541 in 1916), Fairbanks has electric lights, telephones and the telegraph, a central steam-heating plant and other modern conveniences.

FAIRBANKS, CHARLES WARREN (1852-), an American lawyer, former Senator, and for one four-year term Vice-President of the United States. He was born near Unionville Center, Ohio, of which state his father was one of the pioneers. The son received his early education in the common schools, and was graduated from Ohio Wesleyan University in 1872. He was admitted to the bar in 1874 and removed to Indianapolis the same year. In 1896 he was delegate-at-large to the Republican national convention in Saint Louis, and was appointed a member of the United States and British Joint High Commission which met in 1898 in Quebec to adjust the Canadian questions relating to the Alaska seal fisheries.

CHARLES W. FAIRBANKS

Fairbanks was elected to the United States Senate in 1897 and was reëlected at the expiration of his term. In 1904 he was elected Vice-President of the United States on the ticket with Theodore Roosevelt; at the close of his official term of office he made a tour of the world. In 1916 he received the complimentary vote of his state in the Republican national convention for the office of President of the United States, and was nominated for the Vice-Presidency on the ticket which was headed by Charles Evans Hughes.

FAIRIES, *fair'iz.* In James M. Barrie's charming play of *Peter Pan,* when Peter advances to the footlights and says appealingly, "Do you believe in fairies?" grown people as well as children cry, "Yes! Yes!" and mean it, too. For the moment they do believe in fairies—the little beings are too beautiful, too delightful not to be real. To children at certain stages of their experience they are the most enticing, the most important inhabitants of the earth. Every flower cup may be a fairy's bedroom; every mushroom is a fairy's dining-table. The gauzy-winged butterflies are the fairies' airships, and very often in the woods and fields of a summer's morning may be seen the rings where their tiny feet have danced all night. True, the most watchful child has never caught a glimpse of one, but almost every child has felt many a time that he might have seen one had he turned about just a little more quickly. As the little girl in the song says:

> I know whenever fairies pass,
> Because they lightly bend the grass;
> I never see them, so I think,
> They must go by just when I wink.

Fairies do not like the cold, so they are not to be found in the fields in the winter, but there is one place where they can always be found, and ready indeed are they at all times to come out and play with the delighted children. From between the covers of the favorite fairy-tale book they glide, and with a wave of their wands carry the children with them to wonderful countries "that never were on land or sea." There is Cinderella's fairy godmother—she does not look much like a fairy, but what a powerful one she is, with her wand that can turn pumpkins into chariots! And Jack's fairy that he met at the top of the beanstalk—the beautiful lady with the star-tipped wand—what could he ever have done without her advice? Sometimes the fairies in these wonderful tales carry away a child from its wicked parents and bring it up happily among themselves; sometimes they bear away to their fairy home some man who deserves punishment, and there make his life a burden to him; or they make it possible for a poor little girl who is out tending the goats, and never has enough to eat, to spread for herself each day a fairy table with everything on it that she likes the most. One thing may be depended on—the true fairies are always found assisting the good people, and no one who is cruel or cross or greedy ever need look for any help from them. If the moral of these tales be very obvious, the children do not mind; that is the way, it seems to them, that the world should be managed.

Fairies may be of almost any size or appearance; indeed, they can look like anything they choose, changing between one moment and the next. A favorite device of a fairy who wants to find out about the worthiness or unworthiness of a person is to appear as a poor old woman seeking aid, and then, when she has found out all she wants to know, to throw off her disguise. The Irish, who seem to know the most about fairies, declare that they prefer to appear as tiny men and women, the men in gay attire of—

> Green jacket, red cap
> And white owl's feather;

the little ladies in gauzy gowns and bonnets made of flower petals. Long after children have ceased to believe that there actually are fairies they love to read of their marvelous doings and to satisfy their inborn sense of justice by gloating over the way the fairies always reward the good and punish the evil in the end.

Should Fairy Tales Be Told? There are people who do not believe in telling fairy stories to children, but the weight of opinion is all in the other direction. Educators hold that, besides giving pleasure, such stories perform a real service in stimulating the imagina-

tion; that they are the natural mental food of children or of older people in an earlier stage of development is shown by the way they have been built up.

Many of them are not artificial products, invented and written out at a sitting, but gradual growths which have been handed down for centuries by word of mouth. It seems as if people had the feeling that a certain element of wonder was necessary in the world, and knew no other way to introduce it. A message must be carried instantaneously from one kingdom to another; a prince must arrive at his realm, many miles away, before an hour has passed or he will lose his sovereignty —and how could these things be accomplished except through the aid of fairies? To-day the message could be sent by wireless telegraphy or by the telephone; the prince could board an express train or soar through the air in an aeroplane almost as swiftly as ever a fairy could carry him. Far more marvelous things than the most ingenious fairy chronicler ever conceived of happen every day, and are scarcely thought of; and a present-day number of a journal of science or invention would have seemed more fantastic to the reader of a century ago than do the tales of Grimm or of Andersen to-day.

The "Grown-up" Phase of Fairy Lore. Time was when sedate grown people believed in the "little folk," as the fairies were affectionately called, for without them they could not account for much that they saw in the world. Knowing little of science or of the laws of nature, they had to introduce supernatural agencies. If the cream turned sour over night, or if the butter would not "come," the housewife had offended the fairies, and they were taking their revenge; if a child sickened suddenly and died, the evil fairies were to blame. Gradually, as education spread, these beliefs passed away, but the delight of children in fairy tales had become evident, and people continued to tell them and to write them for that reason. Some of those which are read and loved to-day, as *Cinderella,* for instance, were written far back in the time when a belief in fairies was widespread.

Even to-day in most countries there are those among the peasant classes who cling to their belief in fairies or kindred beings. For the fairies are not the only class of sprites that figure in folklore. There are the *dwarfs,* or *gnomes,* clever, malicious little creatures that live underground and guard the jewels and metals there hidden; there are the *trolls,* little old men who live in the hills and steal forth to carry away children and valuable property; and the *nixies,* or water-sprites, who love to entice men into their caves in the sea. The famous Lorelei (which see) was one of these. Nations differ, too, in their ideas concerning fairies, those of Russia, for instance, being very different from the English fairies. Of these latter Shakespeare gives most charming pictures in his *Midsummer Night's Dream.* F.J.C.

FAIR'MONT, W. VA., noted as a coal-mining center, is the county seat of Marion County. It is situated in the northern part of the state, at the head of navigation on the Monongahela River. Morgantown is twenty-five miles northeast, and Wheeling is eighty miles northwest. The Baltimore & Ohio Railway, constructed to the city in 1852, and the Monongahela Railway, built to this point in 1915, afford railroad transportation, and interurban lines connect with cities north, west and south. The city's population, largely American, was estimated to be 15,506 in 1916, by Federal estimate; the census for 1910 gave a population of 9,711.

Fairmont occupies both banks of the river, the opposite sections being connected by a steel suspension bridge. The coal industry leads in its commercial activities, but the trade in glass products is also important and foundries, planing mills, machine shops, flour mills, cigar factories and pottery works are included in the city's industrial plants.

The most notable buildings are the Federal building, erected in 1914 at a cost of $125,000; the Marion County courthouse, erected in 1895 at a cost exceeding $350,000; the $350,000 Watson building, erected in 1910, and the high school building. Fairmont is the seat of the state normal school, which, with a business college and public library, supplements the public school system. The city has two hospitals; one, exclusively for miners, is maintained by the state.

In 1819 the site of Fairmont was laid out as Middletown, and in 1842 Middletown became the county seat of the newly-established Marion County. Two years later its name was changed to Fairmont.

FAIR OAKS, BATTLE OF, also known as the **BATTLE OF SEVEN PINES,** was an engagement of the War of Secession, fought during McClellan's Peninsular Campaign on May 31 and June 1, 1862. Fair Oaks was a station on the Richmond & York Railroad, seven miles east

of Richmond, and Seven Pines the name of a tavern on the battlefield. In the battle about 42,000 Federals under McClellan engaged an equal force of Confederates under Joseph E. Johnston and G. W. Smith. After the battle of Williamsburg, which occurred on May 5, Johnston began a slow retreat toward Richmond. McClellan, who was following him, threw his left wing, under Heintzelman and Keyes, across the Chickahominy.

On the morning of May 31 Johnston sent a Confederate force to attack this wing, and only the arrival of reënforcements under Sumner saved the Federals from a serious defeat. The Confederates were then driven back with heavy losses, Johnston himself being among the wounded, and General Smith taking chief command. On the following day, after the Federal left had repulsed an attack by Longstreet, General Robert E. Lee superseded Smith, and on the night of June 2 the Confederates withdrew to Richmond. The total Federal loss was about 5,000, and that of the Confederates, about 5,200.

FAITH CURE. This term, also known as mental healing and psycho-therapeutics, refers to the recognized influence of the mental attitude upon the bodily processes. The normal functioning of the processes of digestion, respiration and circulation, and that of all the complex chemical processes which determine energy and well-being, are peculiarly dependent upon the proper action of the nervous system; this last, in turn, is most intimately bound up with the attitudes of mind—hope, fear, apprehension, despondency, worry, attention to symptoms (pains). In addition, this mental factor is peculiarly prominent in certain forms of ailment known as functional nervous disorders. The disappearance of symptoms under strong mental stimulation is thus explained. The disorder known as hysteria provides the most favorable culture-bed for such effects. Hysterical symptoms are not the products of shamming, but of an exceptional suggestibility; impediments, in the form of conviction that muscles cannot be controlled, induce paralysis. The sight of disorder, as of twitching or convulsions, induces the same symptoms in the hysterical; nervous disorders may thus spread by contagion.

On the basis of such observation it follows that a strong belief in the power of a religious ceremony, the laying on of hands, prayer, the [illegible] a shrine, the touch of a relic, may [illegible]ous impediments to health and prepare the way for a prompt or gradual improvement and cure. This influence may be traced in the history of miraculous cures from ancient times. J.J.

Relating to Various Beliefs. The articles on the following topics, while not bearing on Faith Cure, are of interest in this connection.

Alchemy	Palmistry
Astrology	Phrenology
Clairvoyance	Psychical Research
Conjuring	Psycho-Analysis
Demonology	Physiognomy
Divination	Spiritualism
Hypnotism	Suggestion
Magic	Superstition
Medium	Telepathy
Mesmerism	Theosophy
Mind Reading	Trance
Necromancy	Witchcraft
Occult	

FAKIR, *fa keer'*. Because of the resemblance between the word *fakir,* which comes from an Arabic word meaning *to be poor,* and the slang word *faker,* which is probably from an old English word meaning *to deceive,* most people have the erroneous impression that all fakirs are dishonest. India is the home of fakirs. There, some of them are ascetics who live in communities and are very devout Mohammedans; others are wandering beggars who torture themselves in all sorts of ingenious ways, either from sincerely ascetic motives or to convince the people of their holiness; still others are jugglers and sleight-of-hand performers, said to be the cleverest in the world. The first class probably constitutes the majority.

FALCON, *faw'k'n,* or *fawl'k'n,* a strong, graceful, powerful hawk, at one time widely used in hunting game. Its claws are sharp and hooked, its short, stout legs are heavily feathered, and its curved beak is armed with a sharp hook. The peregrine falcon, known in America as duck hawk, is the one preferred for hunting. Its upper parts are slate colored, the under parts cream, barred with dark slate or black, excepting the upper part of the breast. The female peregrine is most val-

THE FALCON

ued because she is so fierce, quick and perfect at the work of catching game. She is about seventeen inches long, with a forty-two-inch spread of wing. Falcons inhabit wild places and prey on grouse, ducks, pigeons, rabbits, etc. They usually build their nests on high ledges of rock. Other American true falcons are the pigeon-hawk and the sparrow-hawk.

Falconry or Hawking, an amusement of Oriental origin, is the pursuit of game by means of trained falcons or hawks. The falcons are taken to the field hooded and leashed, carried on the shoulder or wrist of the trainer or master, and when the game is seen the bird is unhooded and loosed. Having been trained, it catches the prey and, instead of devouring it, brings it to the master. Falconry was a favorite sport of princes, nobles and ladies in the Middle Ages, but in England it declined in the seventeenth century with changes in agricultural conditions and the introduction of firearms. The United States and Canada are well adapted to falconry, having the greatest variety of hawks and the best opportunity for flying them. Several clubs have been started to encourage the sport, but it does not give promise of becoming a popular pastime.

FALCONBRIDGE, *fawk'on brij,* SIR [WILLIAM] GLENHOLME (1846-), a Canadian jurist, since 1900 chief justice of the king's bench of the supreme court of Ontario. Sir Glenholme was born at Drummondsville, Ontario, attended school at Barrie and Toronto, and in 1866 was graduated with honors from the University of Toronto. He was for several years a teacher of modern languages, but in 1871 was called to the bar, the profession in which he was destined to rise to the highest ranks. In 1872 he was appointed an examiner in his *alma mater,* and until 1881 was also registrar. From 1881 to 1896 he was a senator of the university. In 1887 he was appointed a judge of the queen's (now king's) bench, of Ontario, and since 1900 has been chief justice. From 1896 to 1900 he was an active member of the commission for revising the statutes of Ontario. Sir Glenholme is justly regarded as one of the great jurists of the Dominion, and is also known for his numerous translations from the Latin, Greek and German poets. The honor of knighthood was conferred on him in 1908. G.H.L.

FALCONER, *faw'k'ner,* ROBERT ALEXANDER (1867-), a Canadian educator and clergyman, chosen president of the University of Toronto in 1907. He was born at Charlottetown, Prince Edward Island, was educated at Queen's Royal College, Trinidad, British West Indies, and later studied at the universities of London, Edinburgh, Leipzig and Berlin. In 1892 he was ordained a Presbyterian clergyman, and thereafter, until 1907, he was in turn an instructor, a professor and principal of Presbyterian College at Halifax. In 1907, the year in which he became president of the University of Toronto, he was also appointed to the joint committee to promote a union of the Presbyterian, Congregational and Methodist churches in Canada. Dr. Falconer is the author of *The Truth of the Apostolic Gospel* and numerous articles on New Testament subjects. He was created Companion of the Order of Saint Michael and Saint George (C. M. G.) in 1911.

FALCONIO, *fal ko'nyo,* DIOMEDE (1842-1917), an American Roman Catholic cardinal, born at Pescocostanzo, Italy. After finishing his novitiate in the Franciscan Order in 1865 he emigrated to America at the age of twenty and became a naturalized citizen, this fact entitling him to recognition as an American by the Roman Catholic Church. He was ordained priest in Buffalo in 1866 and in the same year became professor of philosophy at Saint Bonaventure's College, Allegany, N. Y. From 1872 to 1882 he was administrator of the cathedral at Harbor Grace, Newfoundland, but returned to Italy in 1883 and held various high positions in the Church, including the archbishopric of Matera. He served as apostolic delegate to Canada from 1899 to 1902, and was then transferred to Washington in a similar capacity. On October 28, 1911, he was elevated to the cardinalate, being one of three American cardinals appointed at that time by the Pope, the others being John Murphy Farley and William Henry O'Connell. He is the author of a volume of *Pastoral Letters.*

FALKLAND, ISLANDS. *fawk'land,* The southernmost unit in the British Empire is the crown colony of Falkland Islands, which includes the islands proper, a rocky group 300 miles east of the Strait of Magellan; South Georgia and the Sandwich Islands, 1,000 miles farther east; and Graham Land, a part of the Antarctic continent, with the neighboring South Orkney and South Shetland islands. The chief industry of the 3,000 people in the Falklands is sheep-raising. South Georgia has a whaling settlement, the Shetlands have seal fisheries, and the Orkneys and Graham Land are the sites of Argentine meteorological stations.

Of the 6,500 square miles in the Falkland group, 3,000 are in East Falkland, which contains the capital, Stanley; 2,300 square miles are in West Falkland, and the remaining 2,200 are divided among a hundred smaller islands. South Georgia contains about 1,000 square

THE FALKLAND ISLANDS

miles; the South Shetlands, nearly 900, and the South Orkneys, about 800. The Falklands were discovered by the English Captain Davis in 1592, and have since been occupied by France, Spain, England and the republic of Buenos Aires. They have been an undisputed British colony since 1833.

FALLACY, *fal'a si.* When a father says, "I succeeded in getting through life with only an ordinary education, and therefore my children don't need anything better," he is guilty of a fallacy. This word comes from the Latin verb meaning *to deceive,* and is the name given in logic to a blunder in reasoning, whether deliberate or unintentional, that leads to a wrong conclusion. See Logic.

FALLIÈRES, *fal yair',* Clément Armand (1841-), a French politician, statesman and eighth president of the French Republic, was born of peasant ancestry in Mézin in the department of Lot-er-Garonne. He received his education in Paris, studied law and soon became conspicuous as a speaker and debater. In 1868 he entered political life and in 1876 was elected as a Republican to the Chamber of Deputies. He was appointed an undersecretary in the Department of the Interior in 1880 and became Minister of the Interior in 1882, subsequently becoming Minister of Public Instruction under Ferry. In 1890 he was elected Senator from Lot-et-Garonne, and in 1899 became president of the senatorial body, being elected eight successive times. The Socialists and Radical Republicans elected him as President of the Republic in 1906 to succeed Loubet, and he assumed office on February 18 of that year.

Because of his democratic ideas he was [illegible]r with the masses throughout his career and evinced a desire to give the laboring element greater recognition. In 1913 M. Poincaré succeeded him as President of the republic, and he retired to his estate at Loupillon in Southern France.

FALLING BODIES. From the time of Aristotle to the end of the sixteenth century it was believed that if two bodies of unequal mass were dropped from the same height at the same time, the heavier body would reach the earth first. An Italian named Galileo, who lived during the latter part of the sixteenth and through the first half of the seventeenth century, was the first man to disprove this theory. Others had questioned and disputed it, but Galileo decided to prove that Aristotle was wrong. Accordingly, about the year 1590, he went to the top of the famous leaning tower of Pisa and dropped at the same instant a small cannon ball and a large one. They reached the ground at nearly the same instant, so he came to the conclusion that it was the resistance of the air that made for difference in velocity and not the difference in weight. The dispute was not settled finally until after the invention of the air pump in 1660. Then it was shown that when a feather and a coin were dropped simultaneously in a long tube from which all the air had been pumped, they fell side by side and reached the bottom at the same instant.

The conclusion was then established that the force of gravity, which is the force that makes bodies fall towards the earth, acts on all bodies alike, regardless of their shape, size or density. Since the attraction of the earth is towards its center, all bodies move in a direct line towards that point. This line is exactly perpendicular to the surface of still water.

The first law of falling bodies states that, under the influence of gravity alone, all bodies fall with equal rapidity. Actually, because of the resistance of the air, bodies fall with different degrees of rapidity. You can test this resistance of the air for yourself by taking, for instance, two sheets from a newspaper and dropping one unfolded and one crushed into a ball from a second- or third-story window. Since both pieces of paper are of practically the same weight, you have a perfect illustration of the fact that it is difference of *shape* and not of *weight* that causes the difference in velocity.

There are three things to be considered in studying the laws of falling bodies. One is the *distance* the body falls—the actual number

of feet it travels; the second is its *velocity,* or rate of speed; and the third is its *acceleration;* for a body does not travel at the same rate of speed throughout its fall. The longer it falls, the faster it travels; that is, its velocity increases with every second that it falls. It has been found that the gain in speed of a falling body, its *acceleration,* in other words, is always the same for each second. The motion of a falling body is described, therefore, as *uniformly accelerated* motion. This means that it is a mathematically exact and unvarying motion, provided the object is acted on by the force of gravity alone. In discussing the laws of falling bodies, v will sometimes be used to represent velocity, a, acceleration, and d, the distance traveled.

It has been found that the acceleration imparted to a falling body is about thirty-two feet per second; the exact number is 32.16 feet. This never varies, therefore a always stands for 32.16. The velocity of a body at the beginning of the first second of its fall is 0; at the end of the first second, or the beginning of the second second, its velocity is 32.16 feet per second. In the second second, therefore, without taking acceleration into account, a body falls at the rate of 32.16 feet per second, the velocity at the beginning of the second. To get the total velocity at the end of the second, the acceleration must be added; therefore the velocity at the end of the second is 64.32 feet per second. Let us, then, state it in this way: the velocity of a falling body at the end of a given second is always the velocity at the beginning of that second, plus the acceleration.

At the end of first second v $(0+32.16)=32.16$ feet per second.
At the end of second second v $(32.16+32.16)=64.32$ feet per second.
At the end of third second v $(64.32+32.16)=96.48$ feet per second.
At the end of fourth second v $(96.48+32.16)=128.64$ feet per second.

The shorter mathematical formula for finding the velocity of a falling body at the end of any given second, is to multiply 32.16 feet by the number of the second. The result obtained would be the same, of course, as that obtained above by addition.

The distance traveled in a given second may be found from the average of the velocity at the beginning and the velocity at the end of the second, as follows:

In the first second $d=\frac{0+32.16}{2}=$ 16.08 feet

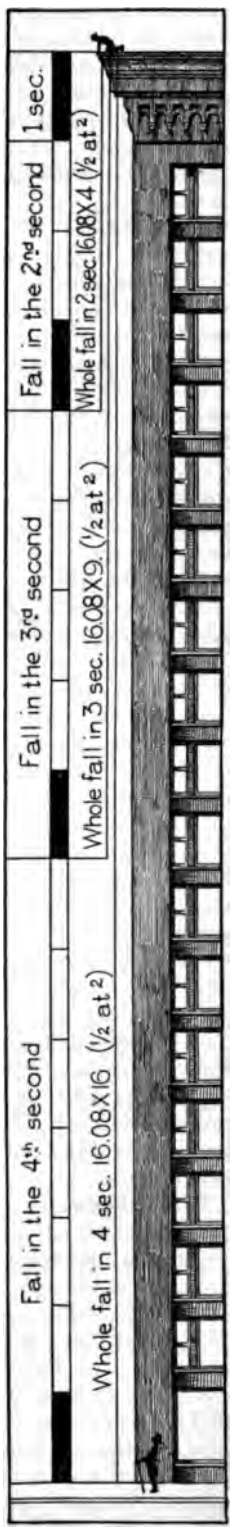
In the second second $d=\frac{32.16+64.32}{2}=$ 48.24 feet

In the third second $d=\frac{64.32+96.48}{2}=$ 80.40 feet

In the fourth second $d=\frac{96.48+128.64}{2}=112.56$ feet

By adding the distance traveled in each separate second, the total distance traveled can be found. In three seconds, therefore, a falling body travels $16.08+48.24+80.40=144.72$ feet. Now, 144.72 may also be divided up in this way: $3\times3\times16.08$. The total distance traveled in four seconds, 257.28 feet, may be divided thus: $4\times4\times16.08$. So a shorter mathematical formula has been worked out which states that the distance a falling body travels in a given time may be found by multiplying 16.08 by the square of the number of seconds. This rule you can prove for yourself by the longer formula just outlined.

The shorter mathematical formula for distance per second is stated in this way: To find the distance a body falls in any given second,



The illustration shows the length of time required for a body to fall from the top of the building to the ground. From the explanation of the laws of falling bodies, as given in the text, and with the help of the formulas in the diagram, the height of the building and the distance the body falls each second may easily be computed by the reader.

multiply the distance it falls the first second by twice the number of seconds, minus one. The distance a body falls in the third second is (2×3—1)×16.08=80.40 feet; in the fourth second, (2×4—1)×16.08=112.56. This tallies exactly with the results obtained in the longer formula given above. See GRAVITY; GRAVITATION. C.R.M.

FALL LINE. When the headwaters of a river are in a rocky region and its lower course is through softer soil, falls or rapids will be formed where it passes from the one to the other. Where the coast of a country is a plain, as it is in much of the Atlantic region of the United States and Canada, there will be a sudden drop in the bed of each river which flows into it from the more mountainous interior. Thus the border of the coast region becomes a *fall line*, or line of falls. Both because of the abundance of water power and because it marks the limit to which ships can ascend the rivers from the ocean, the fall line is the location of many important cities. The most important of these in America are shown on the accompanying map.

THE FALL LINE

The dots represent cities extending from Quebec, Canada, to Columbus, Georgia. These cities can be identified by comparison with political maps.

FALL RIVER, MASS., one of the largest cotton-manufacturing cities in the United States, situated in Bristol County, in the extreme southeastern section of the state. It is on Mount Hope Bay, an inlet of Narragansett Bay, at the point where it receives the waters of the Taunton River. Boston, the state capital, is forty-nine miles north; Providence, R. I., is eighteen miles northwest. Transportation facilities are provided by the New York, Haven & Hartford Railway, by extensive interurban lines and by the steamers plying regularly between Fall River and other Eastern cities; freight steamers communicate daily with Providence. In 1910 the population was 119,295; in 1916 it was 128,366.

Fall River has a safe, deep harbor, capable of admitting vessels of the largest size. Water power for manufacture is supplied by Fall River, which rises in Watuppa Lake, on the eastern limits of the city, and has a descent of 130 feet in half a mile. Large capital has been invested in the kindred cotton industries, which make thread, yarn, calico, prints, ginghams and knit goods; more than 35,000 people are employed in these factories. Besides cotton products, the city makes woolen goods, men's hats, especially those for the United States army, spools, bobbins, cotton-making machinery supplies, rope, twine and rubber. Granite quarrying within the city is also an important industry. There are a number of fine structures built of this native stone, one of the most notable being the city hall. Other noteworthy buildings are the customhouse and post office, the Durfee high school, the Technical high school and the state armory. In addition to its public schools the city has Notre Dame College, a conservatory of music, a free textile school, opened in 1904, and a library with 70,000 volumes. There are hospitals and homes for children and for the aged. Five parks provide recreation grounds.

The first settlement made here by white men was on land obtained by treaty with the Wampanoag Indians. It was a part of Freetown until 1803, when it was incorporated separately. From 1804 until 1834 it was known as Troy. In 1854 it was chartered as the city of Fall River, and in 1862 a part of Tiverton, R. I., was included within its limits. The most serious strike in the history of the textile industry occurred here in 1904.

FALSE IMPRISONMENT, the detention or confinement of a person without authority of law. An example of false imprisonment develops in case one person by false swearing secures the detention of another. If the victim is able later to establish the facts he may proceed by criminal prosecution to secure the punishment of all who conspired against him. Only when a disturbance of public peace or safety has been committed is the imprisonment of a citizen justifiable.

False imprisonment does not arise in case a man is found guilty by a jury, is sentenced to prison and is afterwards proved innocent. The victim in this case has no redress.

FAMILY. See CLASSIFICATION, subhead *Family.*

FAMINE, *fam'in,* a great scarcity of food which causes suffering and death among many inhabitants in a country. The chief causes are destructive floods or the lack of rain, devastating wars, and injurious insects such as the locusts which travel in such swarms that they may ruin crops wherever they go. In early history famines were more common than they are to-day, for transportation and lines of communication were not developed, so when crops failed people could not quickly obtain supplies from more favored districts.

The worst famines in history have been in India and China. English rule has helped India, for the government has set aside an amount of money annually to be used, if needed. In China a great famine occurred in 1877, in which over 9,000,000 people perished; in 1902 there was another, which killed over 1,000,000. In India several have occurred; one visited the country in 1837, when 800,000 perished; another, in 1865, when over 1,000,000 died; and yet another, in 1900, in which about the same number starved to death. During the War of the Nations, Belgium, Serbia and Poland were on the verge of famine before supplies reached them from benevolent neutral countries, but relief was sent in time to save many thousands of the unfortunates.

FANDANGO, *fan dang'go,* one of the three modern national dances of Spain, the other two being the *bolero* and the *seguidella.* These first came into prominence in the sixteenth century. The fandango is danced by two people in 6-8 time, beginning slowly and gradually increasing in speed, until they end in a whirl. Marked by the snapping of fingers, stamping of feet and the clicking of castanets, which are held in the hands of the performers, the dance is lively and full of exultation. A feature of the fandango is a sudden pause of the music towards the end of each measure, upon which the dancers stop in a rigid pose until it starts again.

FANEUIL HALL, *fan''l,* an historic building in Boston, popularly called "the Cradle of Liberty." For description and illustration, see BOSTON.

FARAD, *fair'ad,* the unit of capacity in electricity, named for the great scientist, Michael Faraday. By reference to the article LEYDEN JAR, it will be seen that a charged condenser has a potential power. If one *coulomb* of electricity gives a condenser a potential force of one *volt,* the capacity of the condenser is one *farad.* See ELECTRICITY.

FARADAY, *fair'a day,* MICHAEL (1791-1867), an English chemist and physicist, one of the world's greatest electricians. The taming of electricity to act as man's servant, more powerful than Aladdin's slave of the lamp, was in large part his work.

MICHAEL FARADAY
In middle life.

Faraday was born at Newington Butts, near London, of a poor family. After little schooling he was apprenticed to a bookbinder, but he had very definite ambitions and spent his leisure time reading scientific works and making experiments in electricity, with an old bottle for a battery. The great name in science in the England of that day was Sir Humphry Davy (which see), and in 1812 Faraday had the joy of hearing the distinguished chemist lecture. His notes on the lectures so aroused the interest of Davy, to whom they were submitted, that he made young Faraday his assistant at the Royal Institution. For fifty-four years Faraday was connected with that scientific body, winning constantly greater honors and higher rank.

He made a number of important discoveries in chemistry, his reduction of certain gases to liquid form by pressure being especially noteworthy, but these all sank into insignificance beside his electrical discoveries. Of them the greatest was that of the connection between electricity and magnetism, which had as its practical outcome the production of electric currents by means of a magnet. Because of this discovery the unit for measuring electric current capacity was called a *farad.* Faraday published numerous works dealing with various phases of science, the most important of which are *Experimental Researches in Electricity* and *Researches in Chemistry and Physics.*

FARCE, a form of dramatic composition in which the author has but one purpose, to provoke laughter by means of exaggerated and ludicrous situations. No pretense is made of presenting characters that are true to life, for, in a farce, character is entirely subordinate to plot. Pure comedy often has farcical ele-

ıt this form of drama is distinguished
ce in that its plot is worked out
:he truthful portrayal of character.

, N. D., the largest city of the state,
rtant distributing center and the
:at of Cass County, situated on the
:r, on the eastern border of the state.
service is provided by the Northern
tailway, constructed to the city in
the Great Northern, built in 1881, and
Chicago, Milwaukee & Saint Paul.
l, Minn., across the river, has electric
:onnection with Fargo. Bismarck is
: west; Winnipeg, Man., is 226 miles
ıint Paul, Minn., is 242 miles south-
Duluth, Minn., is 254 miles directly
e city was settled in 1871, was incor-
n 1875 and named in honor of W. G.
the Wells Fargo Express Company.
:he commission form of government,
elective officers, was adopted. The
n was estimated to have increased
official count of 14,331 in 1910 to
1916, as estimated by the Census

s a city of fine streets, beautiful parks
ctive homes. Island Park, containing
e acres; South Park, thirty-five acres;
Grove, thirty acres, are the pleasure
the city. It is the seat of the State
ral College, Fargo College, Oak Grove
and Sacred Heart Academy. These,
business colleges, public schools and
ie Library afford excellent educational
es. A $150,000 Federal building, a
courthouse, a $95,000 auditorium, a
ail, a Roman Catholic cathedral, a
ıt Episcopal cathedral and the Ford
erected in 1914 at a cost of $150,000,
most notable structures. A Federal
e is located here.

:y is situated in the heart of a fertile
:al region, which produces great quan-
wheat, hay, flax and oats. As a dis-
point for heavy farm machinery, it
ıssibly second in the United States.
e more than a hundred wholesale and
ng houses, and large shipments go
la as well as to points in the United
Of its many and varied industrial
nents knitting mills, foundries, cream-
ıttling works, cracker factories and
ile plants are the most prominent;
is also actively engaged in the manu-
of bed springs, mattresses, harness,
nd artificial limbs. There are also
car-shops of the Northern Pacific Railway. The city sustained a loss of $2,500,000 in 1893, when the business portion was destroyed by fire. J.P.H.

FAR'GUS, FREDERICK JOHN (1847-1885), an English novelist whose works were published under the pen name HUGH CONWAY. He took the second part of the name from that of the *Conway,* an English ship. He was born in Bristol and served in the navy before he became an author. Fargus is remembered chiefly for a sensational novel, *Called Back,* which circulated widely in Europe and in America and was also successfully dramatized. It was first published in 1884. Other books written by him are *Dark Days, Slings and Arrows* and *Bound Together.*

FARIBAULT, *fair'i bo,* MINN., the county seat of Rice County, situated in the southeastern section of the state, on Cannon River, at the point where it receives the waters of the Straight River. Saint Paul is fifty-two miles north. Faribault is a railroad center of importance in this section of the state, being the junction of the Chicago, Milwaukee & Saint Paul, the Chicago Great Western and the Chicago, Rock Island & Pacific railways; an electric line extends north to Saint Paul. In 1910 the population was 9,001; in 1916 it was estimated to be 9,712.

Faribault is located in a region dotted with beautiful lakes, and enjoys considerable popularity as a summer resort. The city has ample water power and produces a variety of products, the leading manufactures being furniture, rattan goods, butter tubs, wagons and woolen goods. There are in addition canneries, breweries and planing mills. In its territory, Faribault is an educational center of prominence, having the state schools for the deaf, the blind and the feeble-minded, Shattuck Military School, Seabury Divinity School, Saint Mary's School, and Bethlehem Academy. The city also has a public library.

The first permanent settlement was made in 1853 and named in honor of Jean Baptiste Faribault, a French fur trader. The city was chartered in 1872 and since 1911 has been administered on the commission plan. Faribault was the home of Bishop Whipple, who labored many years among the Indians.

FARLEY, *fahr'li,* JOHN MURPHY (1842-), an American Roman Catholic cardinal, born at Newton Hamilton, County Armagh, Ireland. He received his early education in Ireland under a private tutor and was confirmed

at the age of seven, this privilege being granted for his thorough knowledge of the Catechism. In 1860 his family emigrated to America, and he entered the college of Saint John in Fordham, N. Y., from which he was graduated in 1866; afterward he studied at Saint Joseph's in Troy. His ordination took place in 1870 at the American College in Rome, where he had gone to complete his theological studies.

CARDINAL FARLEY

After his return to America he became secretary to Cardinal McCloskey, and in 1884 was appointed private chamberlain, or official to regulate the Vatican ceremonies, for Pope Leo XIII, and was given the title Monsignore. In 1891 he was appointed vicar-general of the New York archdiocese and in 1895 was made assistant to the archbishop. In 1902, he became the fourth archbishop of New York. At the consistory in Rome in 1911 he was one of the three American archbishops to receive the appointment of cardinal, the others being Diomede Falconio and William Henry O'Connell. He is the author of several historical and controversial works, including a *Life of Cardinal McCloskey* and a *History of Saint Patrick's Cathedral.*

FARM CREDITS. See RURAL CREDITS.

FARMERS' ALLIANCE. See POPULIST PARTY.

FARMERS' INSTITUTE, a meeting of farmers for their mutual benefit and improvement, developed on the general plan of teachers' institutes. In one form or another, usually under the auspices of local agricultural societies, such meetings were held in the United States over a century ago, but it was not until the years following the passage of the Morrill Act of 1862 that they began to take the present name and to receive the support of the states or of the state agricultural colleges. The Massachusetts State Board of Agriculture held a four-day meeting, the first open to the public, in 1862, and four years later the Connecticut State Board of Agriculture held its first farmers' convention. In 1871 the Massachusetts board requested the numerous agricultural societies of the state to hold annual meetings, to be called the *Farmers' Institutes of Massachusetts;* this seems to have been the first use of the name.

Since 1871 the farmers' institute has spread to nearly every state in the Union and to several of the Canadian provinces. A feature of the Canadian system, in the Western provinces, is the use of a special train to convey the institute conductors and their exhibits to every corner of the land reached by the railroads. In the United States, the farmers' institutes are usually under the direct management of the state agricultural colleges or of the boards of agriculture. Wisconsin and a few other states have a special officer, called the superintendent of farmers' institutes, to plan and manage them. It has been estimated that at least 8,000 institutes are held in the United States alone each year.

Among this large number there is necessarily much variety in the character of the meetings. They may last but a day or even half a day, or may continue for several days. The tendency is to shorten the meetings and to have them frequently. The winter, when the farmer's work is lightest, is the season for most institutes, but very successful meetings have been held at other times. The programs are always arranged to give the members abundant opportunity for informal discussion, in addition to addresses delivered by specialists or successful farmers whose reputation is more than local. At the longer meetings it is customary to provide music and other exercises. Young people's institutes and courses of instruction by correspondence are newer developments in the instruction of farmers. W.F.Z.

FARNESE, *fahr na'sa,* the name of an ancient Italian family whose wonderful palace in Rome, built by Pope Paul III, was a treasure house of art. Many beautiful pieces of statuary, such as the *Farnese Bull, Juno* and *Hercules,* which were in the palace, have been moved to the National Museum at Naples, and now only a few classic works remain in its halls.

The family was prominent in the thirteenth century, and in 1534 ALESSANDRO FARNESE, who was then a cardinal, became Pope Paul III. His grandson, Alessandro (1547-1592), after being educated at the royal court at Madrid, became a great general in the Spanish service and, although severe in discipline, was worshiped by his soldiers. He was the famous Duke of Parma, who fought in the Netherlands. In 1714 ELIZABETH FARNESE married

Philip V of Spain, and being naturally of a domineering and ambitious disposition, she completely ruled the king. In 1731 the male line became extinct at the death of ANTONIO.

The palace of the family in Rome, completed in 1575, was owned by the Pope for many years, and then it became the property of the king of Naples. At present it is the residence of the French ambassador to Italy.

Farnese Bull, a group of colossal statuary, represents Dirce about to be bound to the horns of a bull by Zethus and Amphion, the two stepsons of Antiope, for whom Dirce had decreed a similar fate. Antiope stands passively in the background. The group was made by two brothers, Apollonius and Tauriscus of Tralles, in the second century B. C. and, excepting the Laocoön, is the most important surviving work of the Rhodian school of art.

FARNHAM, *fahrn'am,* the county town of Missisquoi County, Quebec, and an important railroad center. It is situated in the extreme southern part of the province, on the Tamaska River, eighteen miles from the United States boundary line. Montreal is forty-three miles northwest, and Saint Hyacinthe is twenty-five miles north. Transportation service is provided by the Stanstead, Shefford & Chambly and branches of the Canadian Pacific and Central Vermont railways. The population, which is chiefly Canadian, was 3,560 in 1911; in 1916 it was about 3,800.

Tobacco is one of the crops of the country around Farnham, and many of the people in the town are engaged in making tobacco products. Car repair shops of the Canadian Pacific Railway are located here; there also are tanneries, shirt and overall factories, manufactories of safes and vaults, building materials and furniture; other industries are grist mills, butter and cheese factories and marble works. Farnham has a town hall, an electric power house, a $15,000 post office, a hospital and a large railway station; these are noteworthy, considering the size of the town. In addition to public and private schools there are a Roman Catholic college, a convent and a public library. A military camp and an experimental farm, in which $20,000 have been invested, are located here.

FAROE, *fa'ro,* **ISLANDS,** (in Danish, FAERÖER), a group of twenty-one volcanic islands belonging to Denmark, lying in the North Atlantic Ocean, between Iceland and the Shetland Islands. Only seventeen are inhabited, the remainder being barren, rocky islets, all covering an area of 541 square miles. The coasts are precipitous, deeply indented and surrounded by treacherous currents which make navigation difficult. The principal islands are Strömö, Osterö, Vaagö, Bordö, Viderö, Sandö and Süderö. The inhabitants—hardy, vigorous Norsemen—are chiefly engaged in fishing and sheep raising. Vast numbers of sea birds nest on the precipices and yield a large revenue to the islanders, their eggs and feathers finding a ready market.

The islands are governed by a parliament, or *lagthing,* of eighteen members and a governor appointed by the crown of Denmark. There is representation in the Danish Parliament. Thorshavn, on the island of Strömö, is the seat of government. Population in 1911, 18,000, an increase of 2,770 since 1901.

FARRAGUT, *fair'a gut,* DAVID GLASGOW (1801-1870), an American naval officer whose brilliant and daring exploits during the War of Secession inspired Congress to create expressly for him the grades of vice-admiral and admiral. At the age of seven he was adopted by Commander David D. Porter (which see), and two years later entered the navy as a midshipman. He served with credit during the War of 1812 and the Mexican War, and between 1854 and 1858 was occupied in establishing the Mare Island Navy Yard in San Francisco Bay.

DAVID G. FARRAGUT

The outbreak of the War of Secession found him on duty at the Norfolk Navy Yard. Having offered his services to the North, he was put in command of a blockading squadron late in the year 1861, and ordered to unite with Porter in the capture of New Orleans. A fierce bombardment of the forts guarding the approach to the city being without result, Farragut ran the enemy's batteries, defeated a Confederate fleet of fifteen vessels, and on April 27, 1862, took formal command of New Orleans. This triumph won him the rank of rear-admiral.

In 1863 he gave valuable assistance to Grant's land forces engaged in the siege of Vicksburg, and the following year took command of a fleet of twenty-five vessels assem-

bled for the capture of Mobile (see MOBILE BAY, BATTLE OF). His storming of the forts and his victorious fight against the Confederate fleet in the harbor, during which he was lashed to the mast of his flagship, was one of the most stirring incidents of the war. This engagement marked the end of his active service. Farragut was created vice-admiral in 1864 and admiral in 1866 (see ADMIRAL).

FARRAR, *fair'ar* (pronounced by herself *fahr rahr'*), GERALDINE (1882-), one of the few American grand opera singers who have risen to fame, was born at Melrose, Mass. She was graduated from the Melrose public school, and received her musical education in Paris and Berlin. Her debut was made in 1901 at the Royal Opera House, Berlin, as Marguerite in *Faust*. She then became a member of the Berlin Royal Opera Company, and, after 1906, of the Metropolitan Opera Company of New York. Her soprano rôles include Marguerite, Madame Butterfly, Manon, Juliette and Tosca, in all of which she has been enthusiastically received. In 1915, by appearing as Carmen for a moving-picture company, she made it possible for future generations to possess a knowledge of her art as an actress. It is declared she received $30,000 for six weeks of this service. In March, 1916, Miss Farrar was married to an actor, Lou Tellegen.

GERALDINE FARRAR

FARRELL, *fahr'el,* PA. (until 1912 known as South Sharon), a city in Mercer County, near Sharon (which see), and near the center of the western state boundary. Farrell is on the New York Central and the Pennsylvania railroads, and has coal-mining and stone-quarrying interests, steel, iron and tin-plate works, and manufactories of chains, stoves, brass and explosives. The population in 1910 was 10,190.

FAR'THING, a bronze coin of the lowest value in English currency. It represents one-fourth of a penny, or the 960th part of a pound sterling. In United States or Canadian money it equals half a cent. The farthing was first issued in the reign of Edward I, and until the reign of Queen Mary it was a silver coin. It is still in circulation, but is scarce except in the poorer quarters of large cities. In large stores, if change includes a farthing, the purchaser is usually given a small packet of pins, a pencil or some other article instead of a coin.

FASCES, *fas'eez,* in the political history of ancient Rome, a bundle of birch or elm rods bound together by a red thong, in the middle of which was an ax. Servants called lictors carried fasces in advance of the king as a symbol of his power to punish by flogging and by putting to death. At the time of the republic they were carried before the consuls and praetors, and later, before the emperor. For illustration, see LICTORS.

FASHION, *fash'un,* a word from the Latin *factionem,* meaning *the make of anything,* is a term applied to styles of dress in vogue for a limited period. Fashion bears about the same relation to costume that weather does to climate, the first in each case being variable and temporary, the other constant and permanent. To appear well dressed one must conform more or less to prevailing styles, for, as Alexander Pope says in his *Essay on Criticism*—

> In words, as fashions, the same rule will hold,
> Alike fantastic, if too new or old.

For centuries men of fashion have looked upon the costume-makers of London as the guardians and creators of correct styles in dress; social leaders among the women have accepted Paris as the fashion center of the world. These arbiters of fashion are not, however, the only factors in determining the style of dress. New modes of living are reflected in contemporary costume, the popularity of the automobile, for instance, making fashionable the tourist's bonnet and veil. Events of world-wide importance which engage the attention of large numbers of people are frequently responsible for fancies in dress. The Balkan War in 1912 started the vogue of Bulgarian colors in men's neckties and women's hat trimmings, and soon after the outbreak of the War of the Nations, in 1914, women began wearing tailor-made suits modeled on the military coat of the soldier. In 1915-1916, full short skirts, reaching to the shoe tops, became popular, a style adapted, it was said, from the uniform of the French hospital nurses in the war.

Books and plays have been known to inspire new styles of dress, one of the most interest-

ing examples being the adoption of the "Lord Fauntleroy" suits for small boys, when Mrs. Frances Hodgson Burnett's *Little Lord Fauntleroy* became popular. Later the artist Outcault, with his *Buster Brown* pictures, created a furore in behalf of "Buster Brown" suits for little boys. Fashion also dictates how men and women shall wear the hair, and there are even varying styles of walking. It is the exceptional community in which may be seen year after year an unchanging style of dress. In some districts of Holland, however, the people still wear the quaint Dutch costume adopted by their forefathers three hundred years ago, and the peasants in some of the mountainous sections of Central Europe likewise adhere to a costume that is centuries old. See COSTUME; DRESS; DOMESTIC ART; HOME ECONOMICS; SEWING.

FASHODA, *fa-sho'da.* See KODOK.

FAST'ING, voluntary or enforced abstinence from food and drink. Few human beings have survived for more than a week when totally deprived of both liquids and solids. When water is supplied, life may be prolonged many days. It is generally believed that death from starvation occurs after a loss of four-tenths of the weight of the body. Succi, an Italian, Doctor Tanner of the United States, and several others, are reported to have survived fasts of forty days each, during which time only water was taken into the system. Animals, particularly the hibernating species, endure fasting for longer periods (see HIBERNATION). Experiments have shown that dogs live from thirty to thirty-five days when deprived of both food and drink. Fasting for short periods is now successfully employed in modern medical science in the treatment of certain physical disorders, such as indigestion and some forms of fever. J.H.K.

FASTS, total abstinence from food on fixed days, particularly as a religious observance. The practice is common in many religions. The Mohammedans fast from sunrise to sunset during their entire month of Ramadan, or ninth month. The law of Moses prescribed an annual fast on the Day of Atonement, and modern usage includes the eves of the principal Jewish feasts. The Roman Catholic fast days are, strictly speaking, the forty days of Lent (Sundays excepted), the Ember days, the Wednesdays and Fridays of Advent and the vigils, or eves, of certain feasts. There is a distinction between *fasting* and *abstinence,* the former implying total abstention from food and drink, and the latter, refraining from meat only, or from meat and fish at the same meal. The Roman Catholic laws governing fasting, which formerly were very rigid, have been relaxed somewhat, allowance being made for the individual's state of health and the amount of work to be performed by him.

FAT, one of the component parts of all animal and vegetable bodies. The fats in man and other animals and in vegetables are chemically similar, and are compounds of a base of glycerine, with oleic, stearic and palmitic acids. Fats may be divided into three classes, namely, hard, soft and liquid. The hard fats include human fat, the fat of beef and mutton, wax and spermaceti. Soft fats include lard and butter; liquid fats include all vegetable and animal oils which remain in a fluid state at ordinary temperatures.

Fat is an important part of an animal organism. As a poor conductor of heat it preserves the natural heat of the body and also acts as a reserve capable of generating bodily heat by combustion within the animal organism. The fats in the human body are mostly taken into the system already formed in food (see FOOD). As an article of diet fat is essential. It is a heat producer, and should be eaten primarily to keep the internal fires active. Both fats and carbohydrates (which see) take high rank as sources of heat. In cold countries fat is more necessary than in warm climates. In summer it should be eaten sparingly, as the demand for heat is then small. In winter a fatty diet enables the body to maintain a sturdy resistance to cold and chills. The Eskimo who eats plentifully of fat or tallow at a meal is not merely satisfying an apparently uncultivated taste; he is laying up a store of necessary heat. The fat pork seen daily on the tables in lumber camps of the north is for the same purpose.

Fat is the base of all soaps, and is largely used in the manufacture of candles. In cooking fat is also of great value. It can be raised to a very high temperature without boiling, and food cooked in fat is covered with a thin film which prevents the escape of nutritious juices.

How to Reduce Fat. Excessive accumulation of fat is a source of discomfort to many persons, and various methods of reducing the weight have been carefully worked out by dietists and physicians. The so-called "fat cures," frequently advertised and placed on the market, are in almost every case worthless

and fraudulent. It may be said, in general, that the amount of fat can be reduced by decreasing the food and increasing one's physical activity, or both. The principle used in dieting is that the diet should be so regulated that the body is compelled to draw on its reserve stores of fat. According to one system, the total quantity of food is reduced, liquids are taken in limited amounts, and fats and carbohydrates are eliminated. Another method excludes carbohydrates, but retains fats. Each person must follow the method best adapted to his particular case. J.H.K.

FATALISM, *fa't'lizm,* the belief that all events are always prearranged and determined by fate, implying either divine will or physical causes as the underlying force. In other words, a fatalist is disposed to accept every event in human life or in nature as preordained and controlled by fate, thus eliminating freedom of will.

THE THREE FATES

* * * And sing to those that hold the vital shears;
And turn the adamantine spindles round,
On which the fate of gods and men is wound.
—MILTON: *Arcades.*

FATES, *fayts,* three goddesses who were supposed by the Greeks and Romans to preside over human destinies and spin the thread of life. Originally the three were said to exercise their powers collectively, but la ends divided them, alloting certain t each. *Clotho,* the spinner, spun the th life; *Lachesis* traced the fate of man; cut the thread of life with the shears tiny. In ancient art *Clotho* was usua tinguished by a spindle, *Lachesis* by ro in her hand, from which she drew the man; *Atropos* held in her hand a roll let on which she recorded the fate, picted by pointing to a sun-dial the which man must meet his death. The panying illustration shows a more mode ception of the Fates. Clotho stands s the thread, which is passed to Laches is to twist it and decide how long it s Atropos waits with shears ready to thread. The Fates were gloomy, un thetic goddesses, inflexible in purpos shiped and propitiated as beings who p man but never conferred blessings.

FATHER, a title of honor bestowe those of an earlier day who distin themselves as creators in some form of endeavor, or who were associated in ceptional way with important historic It is a title decreed by custom only. T lowing list is representative of the e men on whom the title of Father ha conferred:

Father of America. Samuel Adams, the most energetic of the American pat the movement for independence.

Father of Angling. Izaak Walton, the of a charming discourse on the delights of entitled ***The Compleat Angler*** (1653).

Father of Comedy. Aristophanes, the of the Greek writers of comedy.

Father of English History. The Ve Bede, author of an ***Ecclesiastical History English People.***

Father of English Poetry. Geoffrey C whose celebrated ***Canterbury Tales*** gave verse a standard literary form.

Father of English Pottery. Josiah We who made the manufacture of pottery in E an art. See WEDGWOOD WARE.

Father of English Printing. William who introduced printing into England in

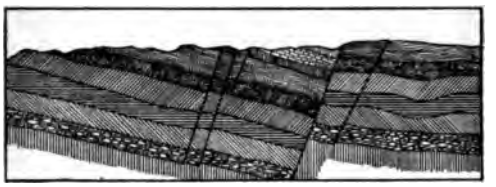
Father of English Prose. Alfred the who inspired and partly wrote the first history which appeared in the native la

Father of Epic Poetry. Homer, the tra author of the celebrated Greek epics, th and the ***Odyssey.***

Father of Greek Tragedy. Aeschylus, great writer of Greek tragedy.

Father of His Country. George Washi the "Father of his Country" to every Am This title has been conferred upon variou men of historic importance; Cicero was h the Father of his Country when he sa

forms what the geologist calls a fault. In the diagram, at the right is shown the different layers of rock in the position in which they were formed; at the left are sections after they have dropped to a lower level. The fault



A FAULT

is at the fracture, to the right of the center of the illustration. Faults are frequently found in mines, for some of which they serve as natural drains.

FAUNA, *faw'na,* the collective name given to the entire range of animal life of any certain part of the world, or of a definite period of time. It corresponds to the word *flora,* which signifies the vegetation of the place or time. The region characterized by certain fauna is called *faunal region,* and may be large or small; for instance, one may speak of the fauna of North America, or of the fauna of any one state or province.

The name originated in the *Fauna* of Roman myths, the goddess of fields and flocks.

FAUNS, *fawnz,* in Roman mythology, the deities of the woods and herds, represented as half human, with pointed ears, short horns, a tail and cloven feet. A notable illustration is the marble *Faun of Praxiteles,* in the Capitoline Museum at Rome, the original bronze of which is doubtfully attributed to the famous Greek sculptor of that name. This statue figures in Hawthorne's *Marble Faun.* See PRAXITELES, for illustration.

FAUST. To many people Faust is simply the hero of Goethe's great drama of *Faust* and of Gounod's famous opera which is based on it, but such a character has no more real existence than Prospero in Shakespeare's *Tempest,* for instance, or than the hero of *Gulliver's Travels.* There was a man, a German astrologer, named Johann Faust, who lived from 1485 to 1540, and about him were woven those weird legends of which Goethe made use. Nor was Goethe the only one who found in his strange career an inspiration; all in all, no fewer than four thousand books were written about him.

When but sixteen years of age, the story goes, Faust, then a theological student at Ingolstadt, became interested in astrology and black magic, and turned to the study of these arts, in which he also instructed his friend Wagner. Having spent a large fortune, he conjured up evil spirits by means of his magic, and made a reckless contract with the devil. According to its terms Faust received Mephistopheles as his servant and embarked upon a riotous career, consulting nothing but his own pleasure, but at the end of twenty-four years the evil spirits carried him off.

The Opera. The music for the world-famous opera based on the Faust legend was composed by Charles F. Gounod (which see). The work has enjoyed unfailing popularity since its first presentation in Paris, in 1859. In this version of the story Faust is an old man, weary of books and learning and disappointed with life. Shown a vision of the beautiful Marguerite, he signs a contract with Mephistopheles, is changed into a young man, and gives himself up to the pleasures of youth and love. In the end, Marguerite dies in prison to the chant of a heavenly choir, as Mephistopheles, carrying out the terms of the contract, drags Faust down with him into the regions below. Other important characters are Dame Martha, companion of Marguerite (contralto); the heroine's brother, Valentine (baritone), who is killed by Faust in a duel; and Siebel, friend of Valentine. The latter rôle is always acted by a woman, as the music for that part is written for a soprano voice.

The popularity of *Faust* is due almost wholly to the exquisite music. Marguerite's spinning-wheel song, *Once There Lived a King in Thule* (Goethe's famous ballad), the stirring *Soldiers' Chorus* of the fourth act, Marguerite's *Jewel Song* and the duet of the lovers, *Forever Thine,* are among the favorite melodies of the opera. The part of Faust has been sung by many noted tenors, among them Jean de Reszke. Madame Melba was one of the most successful Marguerites. M.S.

FAUST, *foust,* or **FUST,** JOHANN (? - 1466), a German citizen of Mainz, who furnished money to produce the first printed book in the world. He was a partner of Gutenberg, inventor of printing. When the latter undertook to produce a copy of the Bible printed with type and was unable to finish it because he lacked the necessary funds, Faust loaned him a large sum of money, taking a mortgage on his business as security. Gutenberg could not repay him, and the partnership was dissolved. Among their printed books were the *Mazarin Bible,* sometimes called the *Forty-*

two-line Bible, from the number of lines of type to a column, and a *Latin and German Bible.* Faust continued the business with his son-in-law, Peter Schöffer, until his death, which occurred in 1466, supposedly from the plague. Several copies of their books still exist. See GUTENBERG, JOHANNES; PRINTING.

FAWKES, *fawks,* GUY (1570-1606), a conspirator who endeavored to avenge the persecution of Roman Catholics in England by blowing up King James I and the Parliament. Gunpowder was hidden beneath the Houses of Parliament, and all was in readiness, when Fawkes was betrayed and captured. November 5 is still celebrated as Guy Fawkes Day. See GUNPOWDER PLOT.

FEAR, a cape in North Carolina, extending from Smith Island into the Atlantic Ocean; it is near the southern extremity of the coastline of the state. Navigation is dangerous around this point, because of the frequent storms; it is this fact which gave rise to its name.

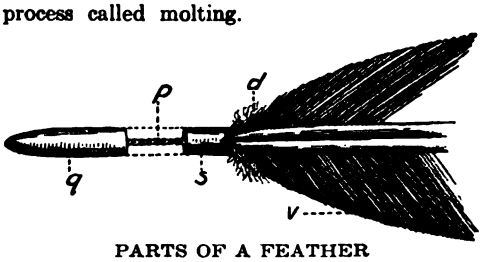
FEASTS. See FESTIVALS.

FEATH'ERS, outgrowths of the skins of all birds, which furnish them the means of flight and provide light, warm, attractive body coverings. They are not only a delight to the eye of man but are of value in the arts and industries.

Four Kinds and Four Parts. In an age long past, the present graceful songster of the air belonged to the same family as the ugly, scale-covered reptile, a kinship which is made apparent by a study of the feathery covering of the bird. With the aid of a microscope one may see the scale-like growths on the skin, from which have pushed forth the wing and tail *quill feathers;* the general covering of *contour feathers;* the soft, plume-like *down feathers,* lying between the later contour feathers, and, finally, the hair-like *pin feathers,* which the housewife singes off in preparing poultry for the table.

Studying just one feather from the point of its growth, one would see first the *quill,* a strong, round, horny, tapering stem, hollow in the lower part, and extending into a pith-filled *shaft.* From each side of the shaft grows a web of fibers called *barbs,* arranged in regular order and forming, together with the shaft, the *vane.* Sometimes the barbs of a vane are edged [illegible] *arbules,* which interlock with [illegible] ges of adjacent barbs. Such a [illegible] ose and strong.

[illegible] not grow from all parts of the skin, however, but only in definite places called *pterylae;* the bare intervening spaces are covered by the overlapping feathers. Periodically feathers are shed and renewed by a process called molting.



PARTS OF A FEATHER

(*q*) Quill (*p*) Pith
(*s*) Shaft (*d*) Downy portion
(*v*) Vane

Commercial Uses. The chief uses of feathers are for stuffing bedticks, quilts, cushions and upholstery; they are also used for ornamentation. In a former day they were made into pens. For the first four uses named, feathers of ducks and geese are most valuable, especially those of the eider duck. Through efforts of Audubon societies there is a diminishing use of feathers as ornaments, but statistics show that feather goods manufactured in the United States yearly are valued at about $35,000,000, and in Canada at about $400,000.

Prices vary with quality, coloring and extent of supply. The most expensive feathers, used in millinery and women's headdress and by Oriental princes, are those of the bird of paradise.

Feathers from the egret, known as *aigrettes,* are becoming more scarce and are growing increasingly expensive. They are used for military plumes as well as on hats and in the hair of women. Drooping, graceful ostrich plumes, in natural colors or dyed in many shades and tints, are used for headdress, muffs, boas and ornamentation of costumes. Soft, light, fluffy feathers of some of the storks are as widely used as ostrich feathers.

Brilliantly-colored feathers of various other birds, such as humming birds, pheasants, grebes, peacock and turkeys, are used for personal adornment by people of all nations and in all stages of civilization, and even the commonest, plainest feathers are dyed and effectively employed.

Related Subjects. The reader is referred to the following articles in these volumes:

Audubon Society	Molting
Bird	Ostrich
Bird of Paradise	Pheasant
Egret	Poultry

FEBRUARY, the second and the shortest month of the modern calendar year. Its name, no longer significant in any way, used to mean a great deal to the ancient Romans, for it came from a word meaning *to purify;* this was the month in which the people were purified for the religious festivals of the following months. The primrose is the special flower for February, and the amethyst is its gem.

Its History. February was not one of the "pioneer" months—that is, it was not in that earliest calendar year which Romulus drew up. Numa, however, added Februaris, but placed it at the very last of the year, and not for centuries was it transferred to its permanent place after January (see CALENDAR).

All the rest have thirty-one,
Excepting February alone,
Which his but twenty-eight, in fine,
Leap Year gives it twenty-nine.

says an old rhyme; but February has not always been so far short of its sister months in the number of days. Until the time of Julius Caesar it had thirty days, but Caesar took one from it to lengthen out his honor-month, July; and when Augustus named the eighth month after himself, he, too, took from February the extra day needed. Every four years comes leap year (which see), and gives to the month a twenty-ninth day.

Its Character. February is cold and stormy in north temperate regions. Often the very heaviest snowstorms of the year come in this late winter month, though it is likely, too, to have occasional warm, sunny days that point forward to spring. There is an old belief, valueless but interesting, connected with February weather. On the second of the month, *Groundhog Day,* it is said the groundhog pushes his way out of his winter burrow and looks about him. If he can see his shadow he creeps back for another sleep of six weeks, but if the day is cloudy he knows that spring has almost come and there is no more time for dozing.

Special Days. February has an unusual number of days of peculiar interest, most of them birthdays. Lincoln, Washington, Dickens, Lowell and Longfellow—these are but a few of the great men whose birthdays fall within this month; and every one of these had the character and the determination to achieve high ambition which make the glory of their lives the most inspiring sort of study.

There is Saint Valentine's Day, on the fourteenth day, named for a Catholic Saint, but given over to that kind of sentiment which must not be taken too seriously. Candlemas Day, which falls on February 2, is a festival of the Roman Catholic Church, during which the candles to be used in services throughout the year are consecrated. (See pages 2146-2147.)

FED'ERAL HALL, an historic building in New York City, the first capitol of the United States, therefore the building in which the First Congress met. The building had been known as the City Hall. It stood at the corner of Broad and Wall Streets; to be more in keeping with the new government it underwent extensive repairs and was rechristened Federal Hall just before Washington's first

FEDERAL HALL

The building which housed the First Congress of the United States, whose most important work was probably the passage of the first ten Amendments to the Constitution. Washington stood on the upper balcony when he took the oath of office as President.

FEBRUARY CALENDAR

Birthdays

3. Albert Sidney Johnston, 1803.
   Joseph E. Johnston, 1807.
   Felix Mendelssohn-Bartholdy, 1809.
   Horace Greeley, 1811.
   Sidney Lanier, 1842.
4. Mark Hopkins, 1802.
5. James Otis, 1725.
   Zebulon M. Pike, 1779.
   Sir Robert Peel, 1788.
   Dwight L. Moody, 1837.
6. Queen Anne, 1665.
   Aaron Burr, 1756.
7. Sir Thomas More, 1478.
   Millard Fillmore, 1800.
   Charles Dickens, 1812.
8. William T. Sherman, 1820.
   Jules Verne, 1828.
9. William Henry Harrison, 1773.
   Samuel J. Tilden, 1814.
   John A. Logan, 1826.
10. Charles Lamb, 1775.
11. Alexander H. Stephens, 1812.
    Thomas A. Edison, 1847.
12. Peter Cooper, 1791.
    Abraham Lincoln, 1809.
    Charles Darwin, 1809.
14. Winfield Scott Hancock, 1824.
15. Galileo, 1564.
    Susan B. Anthony, 1820.
    Elihu Root, 1845.
18. Queen Mary of England, 1516.
19. Copernicus, 1473.
    David Garrick, 1717.
20. William H. Prescott, 1726.
    Joseph Jefferson, 1829.
21. John Henry Newman, 1801.
22. George Washington, 1732.
    James Russell Lowell, 1819.
23. George Frederick Handel, 1685.
24. George William Curtis, 1824.
25. Charles C. Pinckney, 1746.
26. Victor Hugo, 1802.
    W. F. Cody ("Buffalo Bill"), 1845.
27. Henry W. Longfellow, 1807.
28. Raphael, 1483.
    Marquis de Montcalm, 1712.

Events

1. King Carlos of Portugal assassinated, 1908.
2. First Parliament of Great Britain and Ireland met, 1801.
3. Territory of Illinois created, 1809.
4. Last day of hostilities in Revolutionary War, 1783.
5. Victoria Cross instituted, 1856.
6. Reconstruction Act brought forward in Congress, 1867.
8. Mary, Queen of Scots, beheaded, 1587.
   Inhabitants of Schenectady, N. Y., massacred by Indians, 1690.
   Temporal power of the Pope ended, 1849.
9. English gained control of New Amsterdam, 1674.
   John Q. Adams elected President, 1825.
   Jefferson Davis chosen Confederate President, 1861.
   Robert E. Lee took command of forces of Confederacy, 1865.
   Nebraska admitted to the Union, 1867.
10. By Treaty of Paris, France surrendered Canada, 1763.
    Marriage of Queen Victoria and Prince Albert, 1840.
    Upper and Lower Canada reunited, 1840.
    Spanish-American War closed by treaty, 1899.
12. Lady Jane Grey beheaded, 1554.
    Settlement established at Savannah, Ga., 1733.
    Independence of Chile secured by Battle of Chacabuco, 1818.
13. Crown of England offered to William and Mary, 1689.
    Warren Hastings brought to trial, 1788.
    Mutsuhito became Japanese emperor, 1867.
14. Canada became a royal province, 1663.
    Oregon admitted to the Union, 1859.
    Yuan Shih-kai made first President of China, 1912.
15. The *Maine* blown up in Havana harbor, 1898.
16. Surrender of Fort Donelson, 1862.
17. Dual government adopted by Austria-Hungary, 1867.
    Suez Canal first opened to ships, 1867.
18. Inauguration of Jefferson Davis, 1861.
    Germans began submarine blockade of Great Britain, 1915.
20. Congress passed reconstruction bill, 1867.
    Leo XIII became Pope, 1877.
    Revolution began in Cuba, 1895.
21. Washington monument dedicated, 1885.
22. Florida ceded by Spain to the United States, 1819.
25. John Adams appointed first minister of United States to England, 1785.
26. Napoleon escaped from Elba, 1815.
    English Test Acts repealed, 1828.
    Treaty of Versailles signed, 1871.
28. Upper Mississippi River exploration by Hennepin begun, 1680.

FEBRUARY QUOTATIONS

1. The February sunshine steeps your boughs,
   And tints the buds and swells the leaves within. —*Bryant.*

2. I beat the Austrians because they did not know the value of five minutes. —*Napoleon.*

3. By so many roots as the marsh-grass sends in the sod,
   I will heartily lay me ahold on the greatness of God. —*Lanier.*

4. Honour is not won
   Until some honorable deed be done.
   —*Marlowe.*

5. The day is ending,
   The night is descending,
   The marsh is frozen,
   The river dead. —*Longfellow.*

6. Procrastination is the thief of time.
   —*Young.*

7. Oh, a dainty plant is the ivy green,
   That creepeth o'er ruins old!
   Of right choice food are his meals, I ween,
   In his cell so lone and cold.
   —*Dickens.*

8. This above all: to thine own self be true,
   And it must follow, as the night the day,
   Thou canst not then be false to any man. —*Shakespeare.*

9. The little birds twitter and cheep
   To their loves on the leafless larch;
   But seven foot deep the snow-wreaths sleep,
   And the year hath not worn to March.
   —*Symonds.*

10. "Presents," I often say, "endear Absents." —*Lamb.*

11. Honour and shame from no condition rise;
    Act well your part, there all the honour lies. —*Pope.*

12. Let us have faith that right makes right and in that faith let us dare to do our duty as we understand it. —*Lincoln.*

13. Around, above the world of snow
    The light-heeled breezes breathe and blow;
    Now here, now there, they whirl the flakes
    And whistle through the sun-dried brakes,
    Then growing faint, in silence fall
    Against the keyhole in the hall.
    —*Bensel.*

14. Hail to thy returning festival, old Bishop Valentine! * * Like unto thee, assuredly, there is no other mitred father in the calendar.
    —*Lamb.*

15. Soul sincere,
    In action faithful, and in honor clear;
    Who broke no promise, serv'd no private end,
    Who gained no title, and who lost no friend. —*Pope.*

16. A little too late is much too late.
    —*German Proverb.*

17. Better to die ten thousand deaths,
    Than wound my honour.
    —*Anonymous.*

18. The speckled sky is dim with snow,
    The light flakes falter and fall slow;
    Athwart the hill-top, rapt and pale,
    Silently drops a silvery veil;
    And all the valley is shut in
    By flickering curtains, gray and thin.
    —*Trowbridge.*

19. Remember that time is money.
    —*Franklin.*

20. Consider your honor of more weight than an oath. —*Solon.*

21. It is pleasant to think, just under the snow,
    That stretches so bleak and blank and cold,
    Are beauty and warmth that we cannot know,
    Green fields and leaves, and blossoms of gold. —*Hempstead.*

22. Labour to keep alive in your breast that little spark of celestial fire—conscience. —*Washington.*

23. Early to bed and early to rise
    Makes a man healthy, wealthy and wise. —*Franklin.*

24. Strict punctuality is perhaps the cheapest virtue which can give force to an otherwise insignificant character. —*Bayes.*

25. Millions for defense, but not one cent for tribute. —*Pinckney.*

26. Each man, unknowing, great,
    Should frame life so that at some future hour
    Fact and his dreamings meet.
    —*Hugo.*

27. Sail on, O Union, strong and great!
    Humanity with all its fears,
    With all the hopes of future years,
    Is hanging breathless on thy fate.
    —*Longfellow.*

28. Beneath the ceaseless-beating rain
    Earth's snowy shroud fast disappears,
    As sorrow pressing on the brain
    Fades in a flood of tears. —*Dazey.*

For February Study

Evangeline
Frost
Gettysburg Oration
Grackle
Groundhog
Ice
Mardi Gras
Meadow lark
Night
Phonograph
Pine
Rip Van Winkle
Snow
Star
Valentine's Day

ure when it is able to exercise the special kind of activity for which it instinctively craves. As an instance, everybody has noticed how a kitten likes to play with a rolling ball. The instinct of a kitten is to stalk prey and seize it by a sudden leap. The rolling ball sets this instinctive organization in motion, and the kitten derives pleasure from exercising it.

Characteristics of the Feelings. We have seen that feelings are accompanied by pleasure or pain. This is known as the *tone* of the feeling. Besides tone, feelings, including the emotions, are characterized by strength, rhythm and content. *Strength* refers to the intensity of the feeling. By *rhythm* is meant the length and the form of feelings. A feeling, for instance, like anger, rises gradually and then subsides, following a rhythmical motion comparable to the waves of the sea. By *content* is meant the mental state that occasioned the feeling. The content may be very simple, as when we view a beautiful landscape, or it may be complex, as when we are stirred by love of country.

Related Subjects. The reader is referred to the following articles in these volumes:

Interest Will
Psychology

FELDSPAR, *feld'spahr.* If we examine a piece of granite, we notice one substance which gives the rock its prevailing color; it has a pearly luster, and may vary in color from white to pink, red or green. This substance is feldspar; next to quartz and limestone it is the most important rock-forming mineral. Feldspar is a compound of silica and aluminum, combined with potash, soda or lime. So we have potash feldspar, soda feldspar and lime feldspar. Potash feldspar is the most abundant and is generally known as common feldspar—the kind seen in granite. Another name for it is *orthoclase,* a Greek word meaning *splitting at right angles,* and used because the ends of crystals of feldspar form right angles with the sides, which are five in number, so that a perfect crystal of feldspar is five-sided prism. There are many varieties feldspar; one of the purest forms kaolin hich see). Another variety is known as *onstone,* because its surface has the appear- of reflected moonlight. *Labradorite* con- ue crystals, *microcline* is light k, and a peculiar white *albite.* See GRANITE;

FE'LIX, ANTONIUS, a Roman procurator, or governor, of Judea (A. D. 52-60), who rose to power from slavery and governed with excessive severity. His rule was marked by constant disturbance and revolt. Unfavorable reference to him is made in history by Tacitus and in the New Testament (*Acts* XXIII). The Apostle Paul was sent to be judged before him and was held in custody for two years.

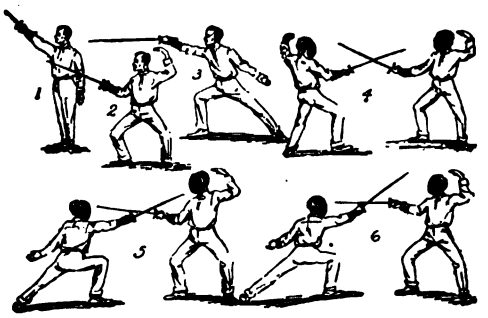
FELLOWSHIP, *fel'o ship,* a sum of money, the income of which is bestowed upon a graduate of a college or university for marked proficiency, to aid him in pursuing further studies. The average amount given to a student is $500; many fellowships are for less amounts, while others are for more, such as the Johnston appointment at Johns Hopkins University, which is $1,500. A fellowship is usually bestowed without regard to the college of which the student is a graduate. However, the holder is expected to do graduate work in the department to which the fellowship is attached, and generally this work must be done at the institution which grants it, or at some other particularly specified.

At the University of Illinois are ten $500 fellowships in experimental engineering, while at Harvard there are thirty teaching fellowships. Most of the money which forms the foundation, or fellowship, comes from personal gifts, bequests, or memorial gifts, while the remainder is appropriated from general university funds. Fellowships in the United States are usually for one year, though the student may be reëlected; but in England the ordinary holding lasts six or seven years, while many fellowships are held a lifetime. In the Sorbonne at Paris the fellowship has become merely an honorary distinction with no money attachment, while in the newer English universities it is rarely worth more than $150, and is held for from one to three years.

FELONY, *fel'o ni,* any offense of a nature so serious as to be punishable by death or imprisonment. The crimes classed as felonies are homicide, or the killing of one person by another, theft, robbery, burglary and like offences. Under constitutional law it is not possible to extend any penalty beyond the loss of life or liberty of the guilty individual, and most states and provinces now define the penalties by statute. A violation of law of less serious nature than felony is punishable by a fine, or brief jail sentence, and is known as a *misdemeanor* (which see).

FELT, from the Dutch *vilt,* is an unwoven material made from wool, hair and fur, matted together with the aid of moisture and heat by a process of rolling, beating and pressure. It is said to be of Asiatic origin, dating from remote times, and the best and most durable felts are still made in Persia and neighboring countries. It was introduced into Europe at the period of the Crusades. In ancient times it was used for tents, hats, coats and carpets. A higher grade of felt has been obtained since the invention of the microscope, which made possible the minute examination of the wool fiber structure, and resulted in more scientific manufacturing methods. Various grades of the material are in use for a vast number of purposes, including millinery, men's hats, carpets, rugs, lining of rubber shoes, gloves, trimmings, etc., and, on account of its heat-resisting qualities, as a covering for steam pipes, boilers, cylinders, etc. It is, perhaps, of the greatest importance as headwear.

FENC'ING, the use of a sword or a foil, or of a weapon having either a point or an edge, for the purpose of attack or self-defense. This use of the foils prevailed for centuries, but within the past hundred years fencing has



POSITIONS IN FENCING

(1) First position
(2) On guard
(3) The lunge
(4) Engagement in tierce
(5) Parry in quarte
(6) Parry in septime

been merely a sport wherein is practiced the art of self-defense. The art is said to have originated in Italy in the sixteenth century, and quickly became popular in Spain and France, where it was one of the principal pastimes of the nobility. It was the usual medium for dueling before that practice began to be regarded with disfavor in the early part of the nineteenth century. Its development was aided by the invention of gunpowder, which rendered armor useless.

Fencing is now one of the favorite sports of modern times, and is played only with light foils or small flexible swords tipped with rubber buttons. Its practice cultivates a graceful carriage, and promotes agility and muscular control. Bayonet fencing is a favorite form of exercise in armies. A bayonet is attached to the end of a rifle and is used in the same general manner as the small sword.

Some of the terms peculiar to fencing may be defined as follows: *Feint,* a movement to mislead an opponent; *parry,* a defense against a thrust; *riposte,* a thrust made after a parry; *appel,* a smart stamp of the right foot upon the ground in a retreat or a feint; *prime* and *quarte* refer to the part of the body to the left of the blade and above the hand; *septime* and *quinte,* to the left but below the hand; *tierce* and *sixte,* to the right above the hand; *octave* and *second,* to the right below the hand.

FÉNELON, *fa n' lawN',* FRANÇOIS DE SALIGNAC (1651-1715), a distinguished French author and churchman, born in Périgord and educated at Plessis College, Paris, and at the Seminary of Saint Sulpice, where he was ordained in 1675. In 1678 he was placed at the head of an institution designed to harbor and convert to Roman Catholicism the young daughters of the Huguenots who remained in France. In 1689 he became the tutor of the grandsons of Louis XIV, and in 1695 was appointed archbishop of Cambrai. His most celebrated work is *The Adventures of Telemachus,* a form of historical romance dealing with the wanderings of the son of Ulysses. His other works, in the domain of philosophy, include *The Maxims of the Saints, The Education of Girls* and *The Temporal Power of the Medieval Popes.*

FENIANS, *fe'ni anz,* a political association of Irish and Irish-Americans, said by some to have been founded in New York and by others to have originated in Paris. Its object was to secure the independence of Ireland and its establishment as a republic. The movement was organized in 1861; it spread through the United States and Ireland and among the Irish inhabitants of Great Britain, resulting in revolt in Ireland and an attempted invasion of Canada from the United States. *Fenian* was the official title of the American branch only, but in the public mind it covered the entire movement. After 1872 the organization continued as a secret society for a number of years. Present-day efforts to improve the condition of Ireland are related under the title HOME RULE.

FENNEL, *fen'el,* an herb of the parsley family, the leaves of which are very fragrant

and are often used, especially in Europe, to season sauces. The seeds also have a pleasing odor and warm taste, and are used to give a pleasant flavor to medicine. Although found wild in the United States and Canada, the fennel is popular in Europe as a garden plant. This herb, with its small, yellow flowers and finely-divided leaves, appears frequently in literature, in the early days, having been an emblem of strength and valor.

FER'DINAND I (1503-1564), and **FERDINAND II** (1578-1637), two Holy Roman emperors (see HOLY ROMAN EMPIRE). Ferdinand I was the son of Charles V of Germany, whom he succeeded as emperor in 1556. Previously, in 1526, he had been crowned king of Bohemia; his claim to the throne of Hungary was assured only after several years of warfare (see AUSTRIA-HUNGARY). His rule as emperor was mild and just, and was notable for his reform of the currency in Germany.

Ferdinand II, grandson of Ferdinand I, succeeded his uncle Matthias as emperor in 1619. Two years before this he was chosen king of Bohemia, and in 1618, king of Hungary. As he was Roman Catholic in his sympathies, his Protestant subjects in Bohemia rose in revolt against him, bringing on the terrible religious struggle known as the Thirty Years' War (which see). With the increase of power resulting from his election to the office of emperor, he was able without great difficulty to crush the Bohemian insurrection. His reign was almost wholly occupied with the Thirty Years' War, the completion of which he did not live to see.

FERDINAND II (1810-1859), king of Naples and Sicily, known as the Two Sicilies. He was nicknamed "King Bomba," and was the son of Francis I. In early life he was popular with the idlers of Naples. In 1830, when he succeeded his father, he promised his subjects to "give his most anxious attention to the impartial administration of justice," but he made only slight concessions, for the burden of taxation was lightened but little and he quickly established a despotism worse than that of his father and gave no heed to the welfare of his people.

In 1832 he married the daughter of Victor Emmanuel and four years after her death married Maria Theresa of Austria. His nickname of "Bomba" arose from his bombardment of [illegible]no from the forts commanding it. In [illegible]olution against him spread over his [illegible] granted a constitution, but a dispute arose as to the nature of the oath for his deputies and he dissolved Parliament in March, 1849. Despotism was again established, and he died just after France and Piedmont, a province in Italy, had declared war against Austria; this struggle resulted in the downfall of his kingdom.

FERDINAND IV (1751-1825), king of Naples, known also as Ferdinand I of the Two Sicilies. His reign was more of a burden than of a blessing to his country. When his father became king of Spain in 1759 as Charles III Ferdinand succeeded him as ruler of Naples. A regency was established, and the young king's education was purposely neglected in order that he might more completely be dominated. In 1768 he married the masterful Maria Carolina, daughter of the empress Maria Theresa, and she set about making Naples a great power. When the French monarchy fell during the Revolution (see FRENCH REVOLUTION), the king and queen joined the union against France and ordered wholesale executions and arrests, which continued until the king was forced to agree to a treaty. When war broke out between Austria and France in 1805 he signed a treaty with France, but soon after formed an alliance with Austria. After Napoleon made his brother Joseph king over Naples, the queen was exiled to Austria, where she died. Ferdinand returned to Naples after the fall of Napoleon, but repudiated his oath after he had twice sworn to maintain the new constitution, thus provoking the enmity of the party which had planned to reëstablish him in power.

FERDINAND V (1452-1516), king of Aragon, who with his wife Isabella deserves some credit in connection with the discovery of America, was born in Sos, Aragon, Spain. He was the son of John II of Aragon, and through his marriage in 1469 to his cousin Isabella, queen of Castile, heiress of her brother, Henry IV, the two kingdoms were united. After a ten years' war it was possible to expel the Moors from Granada and end their rule in Europe. For this act the Pope gave him the title of *The Catholic*. Ferdinand and Isabella played a leading part in Europe; the king, supreme in Aragon, aimed at great political power; the queen continued at the head of the government of her own kingdom.

The discovery of America was the most momentous event of their reign. Ferdinand was indifferent when Columbus first pleaded his cause, but Isabella declared she would under-

take to finance the project for Castile; she therefore furnished three little ships and offered to pledge her jewels, if necessary. Columbus' discoveries made them sovereigns of a new land, and eventually made Spain the first power in the world. After the death of Isabella in 1504 Ferdinand added to his kingdom both Naples and Navarre.

FERMENTATION, *fer men ta'shun,* a chemical change which takes place in animal or vegetable matter through the action of certain organisms called *ferments.* One of the familiar examples of fermentation is the action of yeast in bread dough. Yeast, which is a form of plant life and one of the most important ferments, changes the starch in the flour to sugar, and then decomposes the sugar into carbon dioxide and alcohol. This process is shown in the bubbles of gas which honeycomb a mass of dough that has been set to "rise." The souring of milk, the change of apple juice to hard cider and of sweetened water to vinegar, the ripening of cheese, the decaying of fruit and the putrefying of meat, are other illustrations of fermentation.

Fermentation also plays an important part in the digestion of food. Gastric juice contains two ferments, *rennin* and *pepsin.* The former acts by curdling milk, and the latter by softening the albumin of food so that it will dissolve in water and be absorbed into the blood. When harmful germs of fermentation are taken into the body the acid of the gastric juice destroys them, but if, for some reason, the acid is too weak to do its work, these germs, by the process of fermentation, turn the food sour, and the result is an attack of indigestion.

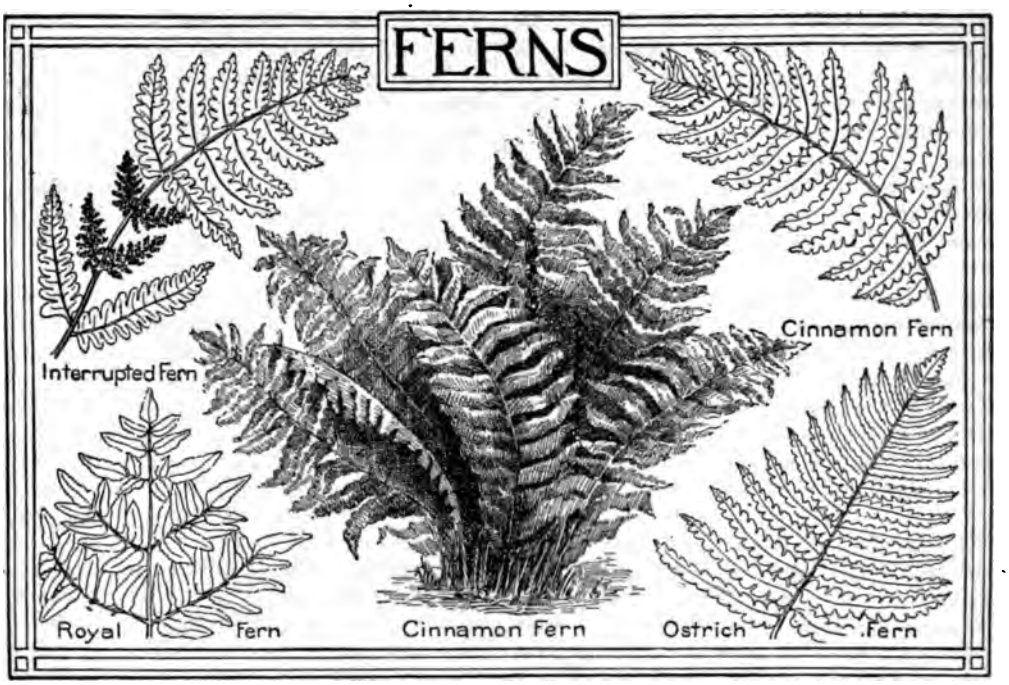
Fermentation is one of nature's wonderful schemes of economy. Plants obtain all their food from the ground and air. When a plant dies it is due to numerous little germs which begin the process of decay; the result is that the plant returns to the ground and air to be used again in the growth of other plants.

The subject of fermentation directly concerns the housewife who is confronted with the task of keeping the food that comes into the home sweet and wholesome; that is, free from harmful fermenting agents. Some of the most familiar devices for preserving household foodstuffs are quite simple. Foods are placed in various containers that they may be protected from dirt, flies and other forms of contamination; bread is always covered so it will not become moldy, etc. Before the ice box became so common the old-fashioned well was utilized as a storage house, milk, butter and other perishable foods being suspended in it on account of its coolness. Now the household refrigerator is everywhere used for keeping foods sweet in the warm season. The ice box itself may become a source of contamination, however, if not kept scrupulously clean. A neglected corner swarming with germs may easily cause milk to turn sour or butter to spoil.

Fruits, vegetables and meats that are canned, pickled or preserved are insured against fermentation by being sterilized and sealed in air-tight, sterilized jars or containers. Certain standard preservatives are in common use in household canning; that is, spice and vinegar for fruits, salt for vegetables, salt, spice and vinegar for pickled goods, and salt and spice for meats. Another device for preserving foods is immersion in oil or fat. This is illustrated when the housewife pours a spoonful of olive oil on top of a jar of pickles or a bottle of olives. In the commercial world the preservation of foods has reached a high degree of efficiency; this is told in the articles COLD STORAGE; FOOD PRODUCTS, PRESERVATION OF; MEAT AND MEAT PACKING. J.F.S.

FERMENTED LIQUORS, *fer ment'ed lik'erz,* a term that includes alcoholic beverages obtained by fermentation, as distinguished from spirituous liquors, which are the result of distillation. The sugar in the juice of fruits is turned to alcohol by fermentation. Grapes so treated furnish wine; ale and beer are made by the fermentation of an infusion of starchy grains which have been previously malted, the starch being turned into dextrin in the process. Cider is made from the fermented juice of apples; mead, the favorite drink of the hardy Norsemen of old, is made from honey. The natives of South Africa make a kind of beer called *twala* from fermented kafir corn. Indians of South America make a liquor named *chica* from corn, and the Kirghiz, inhabiting the steppes of Central Asia, drink *kumiss* made of fermented mares' milk. See ALCOHOLIC DRINKS; DISTILLATION; FERMENTATION.

FERNIE, *fer'ni,* the county town and the provincial police headquarters for East Kootenay district, British Columbia, noted for its immense coal-mining industry, which employs about 1,500 men and has an average annual output of 1,500,000 tons. It is situated near the Elk River, in the extreme southeastern corner of the province, fifty miles west of the



Alberta boundary line and twenty miles north of the Montana state line. The city is served by the Crow's Nest branch of the Canadian Pacific and also by the Great Northern and the Morrissey, Fernie & Michel railways. The place was settled in 1898 and was incorporated as a city in 1904. It was almost completely destroyed by fire in 1908. In 1911 the population was 3,146; in 1916 it was estimated at 3,500, English, Irish, Welsh, Italians and Slavs predominating in the foreign element.

Fernie is located in an agricultural district well adapted to the growing of fruits and vegetables. The coke industry is represented by 500 bee-hive ovens. Other industries of importance are saw mills, machine shops, railway-car shops, foundries, breweries and factories for making fruit boxes, furniture and building material. Noteworthy public buildings are the $100,000 provincial government building, a $100,000 customs office and post office, and a courthouse.

FERNS, *fernz,* a large and important group of flowerless plants, whose delicate and beautiful foliage adds to the attractiveness of the woodlands, and whose habits of growth and reproduction are most interesting. There are [redacted] 4,000 species, found both in the tem[redacted]ns and in the tropics, and ranging [redacted] forms whose delicate, filmy leaves [redacted]s, to the great treelike ferns of South America and the Pacific Islands, which rise to heights of forty feet or more.

In all except the tree ferns, the parts of the plants that are seen are the leaves only, for the stems and roots are underground. Upon the under surfaces of the leaves, or *fronds,* are found round, brownish spore cases, which contain countless minute bodies known as *spores.* When these become ripe, the cases burst open, and the spores, falling to the ground, sprout and produce a tiny, heart-shaped leaf, which is entirely different from the parent fern. Upon this plant are produced the organs from which, in time, a new fern will spring. This method of reproducing is called by botanists *alternation of generations.*

Some ferns grow on the ground, others live in the water, and some attach themselves to other objects. The latter, known as *climbing ferns,* lack the strength to hold themselves up, and so twine about other objects for support. Among familiar varieties of ferns are the asparagus fern, bearing leaves like tiny spines; the brake (which see); the beautiful dicksonia, lady and New York ferns, with long, plume-like fronds; and the delicate maidenhair (which see).

Fern beds make a delightful nook in a school garden. These plants are hardy and will grow from year to year with little care, if planted on the shady side of the schoolhouse. The

children can add to the beauty of the spot by arranging about the bed a few moss-covered rocks from the woodlands. Ferns afford excellent material for drawing and language lessons, and the study of their growth and habits can be made very interesting.

Geologists say that a vast number of centuries ago, in the era known as the Carboniferous Period (which see), many portions of the earth's surface were covered with a dense growth of ferns. These plants, together with others of their type, produced the vegetable matter from which the great coal deposits of the earth have been formed (see GEOLOGY).

FERRERO, *fer ra'ro,* GUGLIELMO (1872-), a present-day Italian historian whose best work, *Greatness and Decline of Rome,* is declared more ambitious than scholarly. In it, however, he shows wide knowledge of economics and psychology. He was born near Naples, the son of a railway engineer, and after studying law he wrote the *Female Offender,* assisted by Lombroso, whose daughter he married. For several years he was conspicuous for his political writings, and these led to lectureships in Milan on militarism. During the year 1906 he lectured at the College de France and two years later, after traveling in South America, he visited the United States and Canada, delivering a series of historical lectures. In 1913 he wrote the historical work, *Between Two Worlds,* and a year later *Ancient Rome and Modern America.*

FERRET, *fer'et,* a yellowish-white, pink-eyed animal, about fourteen inches long, domesticated in America and Europe and kept to kill mice and rats, and to hunt rabbits. It is a native of Africa, and is related to the

THE FERRET

weasels. It looks like a polecat, but it cannot bear cold and cannot live in cool climates except in houses. Having very slender bodies, ferrets can easily enter burrows, and, when muzzled, are used to drive animals from their holes. They seldom devour the animals they catch, but kill them and suck their blood. They must be carefully watched or they will harm infants and kill poultry.

In the Western United States the black-footed ferret is found. It is pale brown, with black feet, and has a black-tipped tail and a black bar across the face.

As a verb, the word *ferret* means to get information slyly or skilfully.

FER'RIS WHEEL, a type of amusement device and a popular feature at exposition grounds. The largest of its kind and the first to be erected, was named after its inventor, G. W. G. Ferris of Pittsburgh, and was built at the Columbian Exposition, or World's Fair, in Chicago in 1893. This wheel was 250 feet in diameter, and carried thirty-six cars, each car holding forty passengers. It weighed 1,100 tons, and cost $300,000. At the close of the Chicago exhibition it was taken apart, rebuilt and operated for a time at North Clark Street and Wrightwood Avenue, Chicago, and later it was set up in Saint Louis. Finally, its size making it too expensive to move from place to place, it was dismantled and sold.

For a number of years small "Ferris wheels," from twenty to fifty feet in diameter, maintained their popularity on the fame of Mr. Ferris' achievement.

FERRY, *fer'i,* a broad, usually flat-bottomed, boat used to carry people, vehicles and freight across rivers and small lakes. The most primitive, used only on small streams, is a flat barge, upon which a horse and carriage can be driven and be carried to the opposite shore. Such a barge is propelled by a chain or rope cable stretched from one side of the river to the other. Small boats used simply to carry passengers are rowed with oars or poles. On large rivers and lakes where travel is extensive, launches and steam vessels, built with both ends alike so that they can go either way without turning, have taken the place of simpler boats. Passenger ferries in New York carry many thousands of people daily back and forth between Manhattan Island and Jersey City and Hoboken, and ferries of like nature ply between San Francisco and Oakland. Railway ferries are now made large enough to carry entire trains across such bodies of water as the Strait of Mackinac and the Detroit and Columbia rivers; there are two such ferries across Lake Michigan, from Milwaukee to Grand Haven and from Escanaba to Frankfort.

FERTILIZATION OF PLANTS. See CROSS FERTILIZATION; POLLEN AND POLLINATION; BREEDING; BURBANK, LUTHER.

FERTILIZER, *fer'ti ly zer,* any substance that will increase crop yields. Plants require certain foods, and in order to get the best possible returns from the land it is necessary that the ground be supplied with the requisite food to convey to the growing plants. As a general rule, it may be taken for granted that soil that has not been called upon to produce crops needs little or no fertilizer when first cultivated. When land has been long cultivated the properties necessary to promote growth are largely taken out of it, and the land needs fertilizers to restore the proper balance of properties. It is always well to bear in mind that different crops exhaust different food elements in the soil, and that the starvation of land due to constant reproduction of one kind of crop can be prevented by a change of crop, commonly referred to as *rotation of crops,* as well as by an artificial supply of fertilizer. In dealing with fertilizers here it is only intended to consider commercial fertilizers, as distinct from natural manures, which are dealt with elsewhere in these volumes.

Requirements of Plants. Plant life requires ten essential food substances; if these elements are not all present in proper proportions naturally, which is very seldom the case, they must be supplied. These substances are oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, potassium, calcium, magnesium and iron. Iron, magnesium and sulphur are generally present in the soil, and it is only in exceptional cases that they have to be supplied. Hydrogen and oxygen are supplied in water. Carbon is received from carbon dioxide in the air. The four almost universally needed plant food substances are calcium, nitrogen, phosphorus and potassium.

The first step of the farmer towards finding out what his soil needs should be to have a sample or samples from different parts of his farm analyzed at the agricultural college of his state or province. This analysis, conducted by experts, will help him in selecting the food substances he must use. If his soil is found to be wanting in calcium, or lime, it can be added to the soil in the form of ground limestone, burned lime such as is used for plastering, hydrated lime, air-slacked lime or wood ashes, which usually contain about one-third lime and some phosphorus and potassium. The amount of lime or any other fertilizer or mixture of fertilizers to be added per acre of ground cannot be definitely stated until an analysis of the soil has been taken, or experimental crops raised, and even then will vary according to the seed to be planted.

Nitrogen is best added to the soil in farm manures, but the most generally used nitrogenous fertilizer is nitrate of soda. This salt is mined in Chile, and is shipped all over the world; it usually costs from $50 to $60 per ton, and contains about fifteen per cent of nitrogen. A soil that is well supplied with lime and decaying organic matter may gain in nitrogen, which is also indirectly received from the air, while the plowing in of clover and alfalfa greatly increases the supply of nitrogen. Another source of the necessary nitrogen is ammonium sulphate, a by-product from the manufacture of coke, which is similar to ammonia combined with sulphuric acid, containing about twenty per cent of nitrogen. Bone meal and dried blood are also used as fertilizers, but they are valuable as feed for hogs and costly as fertilizers.

Soils that are deficient in phosphorus are generally those that are lacking in lime. The phosphorus for fertilizers is mostly mined in the form of phosphate rock in North Carolina, South Carolina, Tennessee and Florida. It is ground to a fine powder and then used as a fertilizer. It usually contains about twenty-five or thirty per cent of phosphoric acid. Most of the phosphorus fertilizer used, however, is obtained by treating the phosphate rock with sulphuric acid, which, although making it more costly, makes it more readily soluble. The phosphate rock derives its phosphorus from the bones of marine animals; in fact, nearly all phosphorus comes from the bones of animals. When bone meal is used as a fertilizer the phosphorus is directly given to the soil.

The potash mines of Germany are the chief sources of the potassium required as plant food. During the War of the Nations, beginning in 1914, this supply was cut off, entailing a scarcity of the product. Kainit, a natural salt mined in large quantities near Stassfurt, Germany, is shipped just as it is when mined and contains about twelve per cent of potash. When treated with acid, however, it usually contains fifty per cent of potash.

Mixed fertilizers as commonly sold contain nitrogen, phosphorus and potassium. When a large quantity of fertilizer is needed it is more economical and satisfactory for the farmer to buy the materials separately and mix them himself. He can thus see exactly what he is using and that the food elements are present

in the proper proportions to meet the requirement of his ground, as it is granted by scientific investigators that different soils and crops require alterations in the proportions in which the composing substances of the fertilizer are mixed. It is also generally conceded that organic fertilizers are preferable to mineral fertilizers, and that methods of intensive farming and rotation of crops preserve the fertility of the soil and increase crop yields, rendering the use of mineral fertilizers almost unnecessary. It should be clearly understood that the use of commercial fertilizers must be absolutely guided by knowledge of the nature of the soil and the crop to be grown, and that the quantities must vary in different localities and climates.

In reasonably good loamy soils phosphoric acid fertilizer for corn will be found more necessary than nitrogen, while in sandy soils nitrogen and potash are more important than phosphorus. The hit-or-miss principle of fertilization, the addition of a fixed quantity of mixed fertilizer to the soil without careful consideration of proportion of the ingredients, should be condemned. Any addition should be the result of intelligent observation of the requirements of the land, either by chemical analysis of the soil or by recorded experiments.

Lasting Effects. The time during which the fertilizer added to the soil will continue effective must depend on the crop that is grown. The various food elements are not absorbed in equal quantities by the growing plants, but the bulletins issued by government agricultural departments will tell the farmers just what elements are exhausted by certain crops and guide him in refertilization. For instance, it is estimated that 100 bushels of corn during growth remove from the soil 148 pounds of nitrogen, twenty-three pounds of phosphorus and seventy-one pounds of potassium. This must be returned to the soil, and to do it the fertilizer must be mixed in the proper proportions. It will be seen that nitrogen will prove the most quickly-exhausted plant food element in the soil. Those lands that are treated with natural manures will more quickly and more naturally receive a quick supply of nitrogen. Nature's way of returning nitrogen to the soil is through organic decay, yet thousands of tons of this most valuable plant food are wasted every year by farmers who do not carry the farm manure out on to the land.

The use of fertilizers must be intelligently governed to produce the best results. To use fertilizer and then plow only to a depth of three or four inches is not giving the plant food elements a chance to do their work. It is a good plan to plow a little deeper each year, till a depth of eight or ten inches is reached. This prevents the lower stratum from packing and souring and gives the roots freedom to collect nutrition from the soil. The requirements of crops in certain soil and climate can only be judged by knowledge of the composition of the soil, and farmers should carefully study these requirements so as to put into the soil the necessary plant food elements in the proportions rendering them most readily assimilated by the plants.

In certain cases commercial fertilizers, while assisting in the production of one crop, may do damage to the actual fertility of the soils. For instance, suppose a farmer applies 200 pounds of mixed fertilizer per acre to his land. This may act as a great stimulant and increase the production, but the larger crop will take more food elements out of the soil than the farmer has put in. To prevent wearing out, he must supply more food than is needed by the crop. The cost of high grade fertilizers, from $38 per ton upwards, renders it an expensive matter to keep pace with the food demands of the crops. Part of this cost may be saved by farmers who will carefully study and mix their own fertilizers while supplementing them with all available farm manures. E.G.M.

Related Subjects. In addition to articles on the ten food products named in the second paragraph, consult the following articles in these volumes:

Agriculture, subtitle	Manures
Agricultural Education	Rotation of Crops
	Soil

FES'TIVALS or **FEASTS**, periods set apart to celebrate some person or event, to rest from labor, or for religious purposes only. Originally all festivals were of the latter character, since the material pleasures connected with them, such as eating and drinking, had to be shared with the gods. The most ancient festivals appear to have been connected with the dead; great banquets were held in their honor, and offerings were made to them. The Greek festivals included the four great national games, Olympian, Isthmian, Nemean and Pythian. The Romans celebrated the Saturnalia, Cerealia, Lupercalia and others. Among the Roman Catholic feasts are the following:

Sabbath	Christmas	Annunciation
Easter	Ascension	Purification
Epiphany	Pentecost	

Feasts are immovable and movable as to dates; the former are those which fall on the same day every year; the latter are those whose dates vary. The principal feast of the latter class is Easter, which determines the time of many of the others. See EASTER; CHRISTMAS, etc., also HOLIDAY; OLYMPIAN GAMES.

FES'TUS, PORCIUS, the successor of Felix as ruler of the province of Judea in the reign of Nero, who appointed him about A. D. 60. He held the place for only two years, when he died. In New Testament history he is mentioned in connection with the case of the Apostle Paul, who had been held a prisoner by Felix. When Paul came before Festus for trial, the latter, who wished to please the Jews, tried to induce Paul to go to Jerusalem for a final hearing, but the Apostle appealed to Caesar, which was his privilege as a Roman citizen, and so was sent to Rome (*Acts* XXV).

FETISH, *fet'ish,* a word from the Portuguese, first applied to objects of worship among the savages of Western Africa. It is descriptive of any material thing credited by the uncivilized with mysterious powers, whose possession can secure for them the services of the spirit lodged within it. Any object may become a fetish providing it can be associated with an event as its cause. Fetish worship, which is the lowest form of religion among savages, exists among the negroes of Africa, the Polynesians, Australians and Siberians. The mascots carried by gamblers and other superstitious persons correspond to the fetishes of the barbarians.

FEUDAL, *fu'dal,* **SYSTEM** or **FEUDALISM,** *fu'dal iz'm,* in European history, one of the most important institutions of the Middle Ages, a form of society and government based on the ownership of land. In the latter part of the fifth century, Gaul, the country roughly corresponding to modern France, was conquered by a race of people known as the Franks, who divided the land among themselves, the king keeping the largest share. As the turbulent and unsettled conditions of that period made it impossible for the king to rule so extended a kingdom, he divided his estates among his warriors, each of whom was given the authority of a sovereign on his own domain. These warriors bound themselves to give military aid to their lord whenever they were called upon to do so; in this agreement are found the germs of the institution [illegible] a definite system about the [illegible] and which reached its highest stage in the eleventh, twelfth and thirteenth centuries.

Development of Feudalism. Feudalism developed rapidly after the breaking up of Charlemagne's great empire, for all classes were glad to put themselves undier the protection of a system that would save them from the lawlessness that then prevailed. Kings and princes gave over their estates to feudal lords, who in turn granted sections of land to lesser tenants, and so on down.

Land so granted was called a *fief,* or *feud.* The grantor of a fief was called *lord, suzerain,* or *liege;* the one who received it, *vassal, liegeman* or *retainer.* The vassal made pledges of loyalty, military service and other aid to his lord, and the lord in turn promised his vassal counsel and protection. Lowest in rank of the several classes, and forming the great bulk of the population, were the *serfs,* who were bound to the soil and who passed with the land when it changed masters.

The feudal system became most thoroughly developed in France, Germany, Italy, Northern Spain, England and Scotland; its cradle was the empire of Charlemagne.

Its Decline. As a system of government, feudalism passed into history with the Middle Ages. Important causes which led to its decay were the opposition of the kings and common people to it, the Crusades, the growth of cities and the introduction of firearms in warfare. The common people opposed it because it gave them no opportunity to advance; the kings hated it because it restricted their power. During the period of the Holy Wars large numbers of the feudal lords lost their lives, and others lost their fortunes and their estates, which so weakened the power of the nobility that the system received thereby a crushing blow.

As the cities grew in power and influence they became strong enough to resist the tyranny of the lord of whose fief they were a part, and in some instances they formed independent governing bodies. The introduction of firearms hastened the decline of the system, because it made the common foot-soldier the equal of the armorclad knight in warfare, thus destroying the military supremacy of the feudal aristocracy.

Its Strength and Its Weakness. In the protection it gave to society during the lawless period following the breaking up of Charlemagne's empire, feudalism rendered its greatest service to European civilization. "It was

the mailed feudal horseman," writes one historian, "and the impregnable walls of the feudal castle that foiled the attacks of the Danes, the Saracens and the Hungarians." Again, tyrannical rulers like King John of England were held in check by the powerful feudal lords, and in this way the spirit of liberty was kept alive during the Middle Ages. Feudalism also fostered the literary tendencies of the period, for in the castles of the feudal lords the wandering bards of medieval times poured forth their songs and romances to eager and hospitable listeners. Honor and respect for women were fostered by the great system of chivalry, the military institution of the feudal organization.

Feudalism was conspicuously weak in that it hindered the growth of strong central governments. This is notably illustrated in the condition of France in the tenth century, when the country was divided among about one hundred and fifty great lords, whose estates were subdivided in turn into about 70,000 smaller holdings. Each of these lords was himself a petty sovereign, and the power of the king was correspondingly weak. Another serious defect was the separation of society into distinct classes, which checked the progress of civilization. The great democratic movements of the modern period would have been impossible under the workings of the medieval system of feudalism. B.M.W.

Consult Abdy's *Feudalism, Its Rise, Progress and Consequences;* Prutz's *Age of Feudalism and Theocracy.*

Related Subjects. There is an illustration connected with this subject in the article Chivalry, page 1359. The reader is also referred to the following titles in these volumes:

Charlemagne	Crusades
Chivalry	Serfs

FE'VER, or rise in the temperature of the body, is an accompaniment of a wide range of diseases; in some of these high temperature is an outstanding symptom, and the word is used as a part of the name in each case; thus we have the terms *scarlet fever, yellow fever, typhoid fever,* etc. Fever is always the result of a disease process which is due partly to chemical changes occurring in the cells, and partly to disturbances of the nervous system produced by toxins of the disease. In every case of fever more heat is being manufactured than is radiated or otherwise lost. The rise above the normal (98.6° F.) may reach 105° or over in certain diseases, and victims of sunstroke sometimes show a temperature of 112° or 115°. The instrument used for ascertaining body temperature is a specially-devised thermometer which is placed in the patient's mouth.

The period of *invasion,* as the first stage of fever is termed, is marked by weakness, languor, loss of appetite, rapid pulse and a chill; then follows the period of *domination,* with the pulse remaining rapid, the surface of the body becoming hot, dry and flushed, and the temperature steadily rising. Thirst, headache, restlessness and rapid breathing are typical symptoms of this fever stage. During the period of *decline* the temperature falls, the breathing becomes less rapid, the skin becomes moist, and the patient begins to feel better. At the height of the fever the patient often suffers from delirium, but during the decline he usually falls into a natural sleep.

There are several types of fever. The name *continued* is applied to that in which the temperature remains above normal for several days; *intermittent* is used when the temperature drops to normal and then rises again after varying intervals; the fever is styled *remittent* when the temperature falls to a point above normal and then rises, such a change occurring a number of times for several days. A decreasing fever may reach the normal and the temperature may rise again after an interval of a few days; such a fever is known as *relapsing.* Treatment depends on the particular ailment from which the patient is suffering. W.A.E.

See the article DISEASE for complete list of all fevers discussed in these volumes.

FE'VERFEW, a favorite plant in the gardens of the Pilgrim Fathers in Plymouth, now common in all waste places and in the vicinity of hedges. The flowers, much like the ox-eye daisy, are white or cream with yellow centers. They grow in large clusters and are sometimes double; they last long after picking and make a pleasing decoration. The plant has a tapering root, an erect, branching stem about two feet high, and grayish-green compound leaves. The feverfew, meaning *flight to fever,* was once supposed to be an unfailing means of driving away fever.

FEZ, the capital of Morocco, in Northern Africa. It is beautifully situated in a deep valley eighty-five miles south of the Mediterranean Sea and 100 miles east of the Atlantic Ocean, and is divided into two parts, old and new Fez, by the river of the same name. The streets are narrow and dirty, and though at

the town presents a most picturarance it is disappointing on nearer en the streets become too dirty to endured water is turned into them nduits from the river.

lucts an extensive trade by caravan nterior, and is noted for its manuf woolen cloaks, silk shawls, and efs, the red caps named for the town), firearms, swords and leather goods. was formerly a center of Arabian ut there remain few signs of its for-

The newer portion of the town is y the government officials and emd Jewish merchants. The old Fez, by ruined walls, contains the busi-ct, each industry being confined to articular section. Population about ee Morocco.

rimless red cap ornamented with a sel of silk or wool, named after the 'ez, where it was originally manu- It is now worn in Turkey, Egypt orth African countries, where it is *rbush*. It was long supposed that sed for producing the dull crimson d not be obtained except in Mo- re it is made from the juice of red has now been chemically produced, ps are made in France and Turkey.

MONEY. A gold piece has a marequal approximately to the amount pon its face; a five-dollar gold piece ve dollars, either in the form of a elted into a mass. Any other coin ain intrinsic value; and most paper greenbacks and gold or silver cer- of value because it is a "promise d may at any time be exchanged for ndard value. *Fiat* money will pass merely because a government has ust be accepted as money. It has hind it to give it value, but a gov- as said, "Let it be money," and it cquires a certain value, which it o hold as long as people have confie government. The Latin word *fiat* rally *let it be*.

t seem that the creation of fiat uld be an easy way for a state to oney scarcity and hard times, but itself a confession of scarcity of cannot produce confidence. No try will accept it as money, and its depreciates. In early times in [illegible]onies more than once issued fiat money, though it was not called by that name, but it soon proved to be worthless. In 1915 the Carranza government in Mexico issued millions of dollars worth of paper money, and when the success of the Carranza cause was in doubt, this money, without redemption value behind it, depreciated until it was worth but a few cents on the dollar. To-day no state of any importance believes it possible to solve its problems or lessen its distress by means of fiat money.

FI'BER, any vegetable, animal or mineral substance which may be separated into threads for spinning, weaving, or for use in various manufactures.

Vegetable Fibers. Most important of the fibers are those obtained from things which grow from the soil. From them are made many of the articles which we wear and use. *Cotton* fiber is perhaps the most common example. It is that woolly substance surrounding cotton seed which, after passing through various processes of cleaning and manufacture, comes to us as cotton batting, thread, yarn or cloth.

The *flax* from which linen thread and linen are made is another important plant fiber. It comes from the stem of the plant. *Hemp,* similar to flax, but tougher and coarser, is used for cordage, rope and coarse cloths. From Manila hemp wrapping paper and cheap writing papers are made, as well as matting, canvas and ropes. *Jute* furnishes a strong bark fiber used for bagging, canvas and carpets. One of the most durable of vegetable fibers is that from the stems of *ramie,* or China grass; from it are made cordage, nets, various fabrics and paper. Chinese grass is valued especially for banknote making. Paper is made from various wood fibers, as well as from fibers of corn husks and of esparto grass.

Among the coarser fibers are *raffia,* used for baskets and mats; and palmetto, tampico and cocoanut fibers, for brushes. *Broomcorn* is also classed by manufacturers as a brush fiber. Palm fibers are manufactured into various articles, and from fiber of young leaves of the jipijapa are woven Panama hats. The finest textile fibers are grown in temperate climates, and nearly all others of commercial importance are obtained from tropical or semi-tropical countries. Each of the fiber plants mentioned above is described under its appropriate title in this work. See, also, CLOTH; PAPER; WEAVING.

Animal Fibers. Wool and silk constitute the

only valuable animal fibers. Under the term wool is included, besides the hair of sheep, that of the alpaca, the Angora and other species of goats, as well as the hair of the camel, musk-ox and yak. All are described in this work under their individual titles. From wool fibers are manufactured many warm articles of wearing apparel. Silk fiber is obtained from the silkworm (see SILK), and comes to us in the form of silk thread and silk fabrics.

Mineral Fibers. Asbestos furnishes the most perfect example of mineral fiber, and its uses are described under that title. Various metals, however, are drawn into fine lengths and woven into fabrics (see GOLD LACE), and glass is spun into a fiber and used in manufactures. M.S.

FI'BRIN, a tough, elastic, jellylike substance found in animal matter. It is fibrin that causes the clotting of blood when it is exposed to the air. When a drop of freshly-drawn blood is examined under the microscope, little strings of solid matter may be seen forming in the watery part and entangling the corpuscles. These threads, which consist of fibrin, are formed by the action of a ferment upon a proteid substance in the blood called *fibrinogen* (see BLOOD).

Fibrin itself is a proteid; that is, a substance consisting of carbon, hydrogen, oxygen and nitrogen (see PROTEIDS). It may be obtained by switching a newly-formed blood clot with a bundle of twigs. Fibrin mixed with other substances will cling to them in threads, and to free the fibrin from impurities it is necessary to rinse it in cold water and then to boil it in alcohol and ether. A substance somewhat resembling animal fibrin is extracted from corn, wheat and other grains, and is known as vegetable fibrin.

FICHTE, *fiK'te,* JOHANN GOTTLIEB (1762-1814), a German philosopher whose influence has been most strongly felt in the later development of German philosophy. He was the son of a poor ribbon-weaver, and his early education was provided for by a wealthy nobleman who was impressed by the boy's evident ability. He studied theology and philosophy at the universities of Jena and Leipzig, then spent several years in tutoring. In 1791 he went to Königsberg, where he met Kant and was encouraged by him to publish his *Critique of All Revelation.* The outcome of this incident was his appointment in 1793 to the professorship of philosophy at Jena. During his five years there he continued to publish his philosophical views, but was forced to resign in 1798 because some of his theories were considered opposed to accepted religious beliefs. For several years thereafter he lectured in Berlin, in 1805 became professor of philosophy at Erlangen and four years later was appointed to the chair of philosophy in the newly-founded University of Berlin. There he remained until his death.

Fichte's philosophy is based on the principle that each person forms his own idea of the external world, but that each one tends to accept as true the same phenomena that are observed by the senses of others. His theory of education, that the chief aim of instruction should be to develop character, has been highly regarded. See KANT, IMMANUEL; PHILOSOPHY.

FICTION, *fik'shun.* The child who demands that somebody "make up a story" for him is calling literally for fiction, since fiction means just that—something *made up.* So far as the derivation is concerned, then, the word might be used to describe many kinds of literature, for poems and dramas are "made up" as surely as are stories. In common use, however, it is restricted to one form of literature—to prose narratives of imaginary events and characters. But there are differences in such narratives. Some could never possibly have happened—they deal with the supernatural, the marvelous, and make no pretense at being true to life. Such are fairy tales and many of that class of longer stories known as romances. The novel, on the other hand, and most of the short stories which com-

prise so large a part of present-day reading matter, deal principally with everyday incidents in the lives of characters who are drawn as true to life as possible.

Prevalence of Fiction. Different ages express themselves in different literary forms. The Elizabethan Age (1558-1603) spoke primarily through the drama, the Augustan Age (1700-1740) through the essay or satire, the Romantic Age (1837-1901) through its exquisite lyric poems, the Victorian Age through its wonderful variety of both prose and poetry; and the dominant literary form of the present age is undeniably fiction. Hundreds of works of fiction come from the press every year; some of these are worth reading, some are not; but almost all find readers, for there are vast numbers of people who never read anything else, and who lack discrimination in selection. The demand for fiction at public libraries is far in excess of that for all other kinds of books combined.

Famous Works of Fiction. No two persons, whether they be critics or the most casual readers, would ever agree thoroughly on a list of the greatest works of fiction, but there are certain books which could scarcely be left out of any such compilations. The following list does not claim to be authoritative—it merely names a dozen works of fiction which anyone who aspires to be well-read cannot afford to neglect:

Don Quixote	Cervantes
Robinson Crusoe	Defoe
The Vicar of Wakefield	Goldsmith
Ivanhoe	Scott
Kenilworth	Scott
David Copperfield	Dickens
Tale of Two Cities	Dickens
Vanity Fair	Thackeray
Henry Esmond	Thackeray
Les Miserables	Hugo
Mill on the Floss	Eliot
Scarlet Letter	Hawthorne

The Well-Paid Fiction Writer. Some of the writers of these world's greatest stories would have heard with amazement of the prices paid to present-day novelists for their tales. A beginner, it is true, cannot hope for large returns—he is fortunate if he disposes of his stories at one cent a word. But when an author has become famous and is so popular that there is competition among publishers for [illegible] of issuing his works, he may [illegible] what he will, with a fair hope [illegible]it. It is nothing unusual, for [illegible] writer whose stories are in great [illegible] paid from fifty cents to a dollar a word, and it is said that Conan Doyle received for his later Sherlock Holmes tales as much as five dollars a word. That is, for a single page of ordinary magazine size he was paid the astounding sum of $4,000.

How to Read Fiction. An unmixed diet of fiction, novel after novel read hurriedly for the story, cannot fail to result in mental indigestion, but this does not indicate that fiction-reading is harmful. With a little care anyone may acquire a method of reading which will not only make fiction immensely more interesting, but more helpful, as well. This does not require actual study, with a dictionary close at hand, but merely close attention to certain phases and to the way the author has accomplished certain results. The following suggestions should enable one more truly to appreciate good fiction:

The Plot. To most people the "story" is the most absorbing phase of a work of fiction; the more exciting and complicating it is, the deeper is the interest aroused. Some novels or romances place all their emphasis on the *plot*, as it is called, making little or no attempt at character-development or at scenic word painting; others seem to use the plot merely to show the development of character. Either style may be excellently done, but the very best fiction presents a combination of the two. Sometimes a plot consists of but one story, and every incident bears directly upon it; again, a whole series of minor plots may be introduced, which only indirectly affect each other.

In reading fiction, such questions as the following, borne in mind and answered, will make the story clearer and give a feeling of mastery which a more hasty reading cannot produce: Has the story a distinct, outstanding climax, to which all the events lead up? Did the author try to conceal the final outcome, that it might be a surprise to the readers? Was he successful in this, or was the outcome evident? Are there subordinate incidents of considerable importance? How do they contribute to the working-out of the plot? Does the central plot stand out clearly, or is it obscured by a too great wealth of incident? Does the story begin with a series of incidents which are not apparently related to each other, but which at the close are blended together?

The Characters. In almost any story there are one or two persons who stand out most clearly, and about whom the plot is woven. Commonly these are called the *hero* and the *heroine*, though in reality they may be anything but heroic. Other persons, sometimes in considerable numbers, appear and play their parts, but generally these are kept subordinate to the central characters. Nothing shows more clearly the genius of a writer than the ability to draw character well—to create people who live and move, and seem to readers to be real persons, to be admired or disliked. Anyone laying aside a play of Shakespeare's, a story of Dickens's or, among present-day books, an *Old Chester* tale of

Mrs. Deland's feels that he has made acquaintances and friends who will long be remembered.

Some such questions as the following will help in the appreciation of character-studies in books: Do the persons in the story seem real? How does the author accomplish that result? Does he describe his characters in detail, or does he allow the reader to find out much about them from their own conversation and actions? Do they at any time act in a way that seems out of keeping with their general character? Do they grow in the course of the story, or are they the same at the close as at the beginning? Are such changes natural, or are they too sudden and unaccountable to be possible in real life? Is the author more interested in his character-development than in his plot? Has the author favorites among his own characters? Does he succeed in making the reader feel toward them as he does?

The Scene. While lengthy descriptions which retard the movement of a story have no place in fiction, a vivid impression of the setting or of the scene in which events take place may add much to the pleasure of the reader. Does the author make the locality in which his scene is laid stand out clearly? Has his city a distinct individuality? Does his countryside differ in any way from all other countrysides? Does the author know his locality thoroughly? Has he introduced "local coloring"—that is, peculiar features of the landscape, peculiar traits in the characters, dialect, mannerisms, tricks of speech? Does he succeed in giving the "feel" of the place?

The Purpose. Had the author any purpose other than that of entertainment? Did he wish to teach a moral lesson, or merely to portray the life of a certain region or of a distinct period of history? Many a good story has no obvious "moral"; no truly artistic work of fiction ever actually points out one, but if it is true to life and is the work of an earnest writer it is sure to carry its lesson for the thoughtful reader.

At first in reading fiction it will be necessary to have these specific questions in mind; later they will become so completely a part of the reader's mental equipment that they will help him in his analysis of the story without his conscious use of them. One point is worthy of note—not all fiction is worth careful study, and many a story repays no more than a hasty reading; but every reader should take care that he does not read exclusively or chiefly such stories. C.W.K.

Consult Baker's *Guide to the Best Fiction in English;* Dawson's *The Makers of Modern Fiction.*

Related Subjects. The reader is referred to the following articles in these volumes:

English Literature	Novel
Literature	Romance

FIDDLER, CRAB, a small crab which abounds on the muddy shores along the eastern coast of the United States, south of Cape Cod. The male of the species is distinguished by the enormous development of one of its front claws, which it waves as if fiddling, hence the name. The female has small claws of equal size. These crabs feed on vegetable matter, and are used as bait. They

THE MALE FIDDLER CRAB

throng sometimes in thousands in marshy places, and their burrowing weakens levees and dams. See CRAB.

FIEF, *feef,* from the French, or **FEE,** in English, is a legal term meaning an estate in land which is inheritable, or descending to the heirs of the grantee. The term originated in feudal times and referred to land held from a lord, or superior, conditional upon the performance of service. The term has three divisions: *fee simple,* or absolute ownership of an inherited estate; *fee,* or private ownership; and *fee tail,* or an estate limited to a specified line of descent, which cannot be disposed of at the will of the owner. See FEUDAL SYSTEM OR FEUDALISM.

FIELD, *feeld,* the family name of three remarkable brothers, two of whom won distinction in the field of law, and the youngest associated with one of the marvels of modern communication, the submarine cable. They were the sons of David Dudley Field (1781-1867), a notable Congregational clergyman who was the author of several histories dealing with Massachusetts.

David Dudley Field (1805-1894), who was born at Haddam, Conn., and educated at Williams College, held a foremost place among American lawyers as an advocate of law reform. Forty years of a brilliant career which began in 1828 with his admission to the bar of New York were devoted to this cause. In 1847 he began the preparation of a code of civil law which was later adopted by nearly all the states of the Union, and which is the basis of the reformed procedure established in 1873 in England. His writings had far-reaching influence, not only in the field of civil and municipal law, but also in that of international relations. In 1873 he was elected first president of an association which met in Brussels for

the purpose of reforming and codifying the laws of nations.

Stephen Johnson Field (1816-1899) became one of the most distinguished justices of the United States Supreme Court. He was born at Haddam, Conn., and, like his brother David, was a graduate of Williams College. After studying law in the latter's office, he became his partner. In 1849 he made his way westward to the gold fields of California, and after the admission of the state into the Union he rendered notable service as a member of the judiciary committee in the legislature. In 1857 he became judge of the supreme court of California, and two years later, chief justice. Field was appointed Associate Justice of the United States Supreme Court by Lincoln in 1863, and during his thirty-four years of service he handed down opinions that are a valuable contribution to American constitutional law. He was a member of the Electoral Commission of 1876, voting with the minority in favor of Samuel J. Tilden. See ELECTORAL COMMISSION.

Cyrus West Field (1819-1892), the man to whom the laying of the first Atlantic cable is chiefly due, was born in Stockbridge, Mass. Giving up the idea of a college education, he entered business life in New York City, and after a career which held for him both failure and success retired at the age of thirty-three with a fortune of $250,000. In 1854 he became very much interested in telegraphic and cable possibilities, and in that year organized a company, with Peter Cooper as its president, to lay a cable from Newfoundland to Ireland. The first attempts were failures, but in 1858 a cable was laid which worked successfully for four weeks. See CABLE.

CYRUS W. FIELD
Who shortened communication with Europe from over a week to less than a minute.

In the meantime Field's firm went into bankruptcy in the financial panic of 1857, and the enterprise was abandoned until the close of the War of Secession. Field, who had never lost faith in the success of the undertaking, renewed his efforts anew in 1865, chartering the [illegible] the largest steamship on the seas, to lay a new cable. The work was completed on July 27, 1866, and this effort proved a triumphant success.

In recognition of his services, Congress gave Field a unanimous vote of thanks and awarded him a gold medal. He thereafter devoted much of his energies to railroad development, and was one of the original promoters of the elevated railroad system of New York City.

FIELD, EUGENE (1850-1895), an American author and humorist, one of the best-loved writers of poetry for children. The Little Boy Blue, who owned the "toy dog covered with dust," the gingham dog and the calico cat that ate each other up in a terrible duel and the boy who was always "seein' things at night" are familiar to countless numbers of children. Taken as a whole, his work reveals a man of most engaging personality, whose boyish gayety, enthusiastic love for children and animals and capacity for friendship are always in evidence.

EUGENE FIELD

The author of *Little Boy Blue* was born in Saint Louis, Mo., on September 3, 1850. When he was seven years old his mother died, and he and his younger brother were placed in care of a cousin, Mary Field French, who lived in Amherst, Mass. There he was prepared for Williams College, which he entered in 1868. A year later he became a member of the sophomore class of Knox College at Galesburg, Ill., but he completed his education at the state university of Missouri. In 1872 he visited Europe, spending, to use his own words, "six months and his patrimony in France, Italy, Ireland and England."

In 1873, after his return to America, Field became a reporter on the Saint Louis *Journal;* this was the beginning of a successful newspaper career. For the next ten years he won favorable notice for his work on various papers in Saint Joseph and Kansas City and in Denver, but his widest reputation was made as writer of a humorous column in the Chicago *Morning News* (later the *Herald*). This column, which was entitled "Sharps and Flats,"

expressed completely his many-sided talent—the ability to write by turns the quaint, the grotesque, the farcical, the sentimental and the pathetic. It was often unexpectedly varied.

In the midst of his journalistic work he found time to write the exquisite poems of childhood that are especially associated with his name. These have been published under the titles *With Trumpet and Drum* and *Poems of Childhood. A Little Book of Western Verse* and *A Little Book of Profitable Tales* represent his finest literary productions. His classical tastes are revealed in his translations of the poet Horace, entitled *Echoes from the Sabine Farm,* and in a volume of essays, *The Love Affairs of a Bibliomaniac.*

The custom of holding Eugene Field exercises and entertainments in the schools is growing in favor both in America and in England. *The Eugene Field Book* contains representative poems of the gifted author, and many interesting facts about his life and personality. It is designed to assist teachers who wish to prepare Eugene Field programs.

This poet of tender fancy and whimsical humor has written some of the most beautiful lullabies and cradle songs in American literature. A favorite among these is the *Norse Lullaby,* two stanzas of which follow:

The sky is dark and the hills are white
As the storm-king speeds from the north to-night,
And this is the song the storm-king sings,
As over the world his cloak he flings:
"Sleep, sleep, little one, sleep";
He rustles his wings and gruffly sings:
"Sleep, little one, sleep."

On yonder mountain-side a vine
Clings to the foot of a mother pine;
The tree bends over the trembling thing,
And only the vine can hear her sing:
"Sleep, little one, sleep;
What shall you fear when I am here?
Sleep, little one, sleep."

At an Allied Bazaar in Chicago in January, 1917, for the benefit of Europe's war sufferers, the original manuscript of *Little Boy Blue* sold at auction for $2,400. B.M.W.

FIELD, MARSHALL (1835-1906), a great American merchant, founder of the largest department store in the world and of one of the greatest wholesale dry goods establishments. He was born at Conway, Mass., and received an academy education. At the age of seventeen he began business life as a clerk in a dry-goods store at Pittsfield, Mass., removing to Chicago in 1856. Four years later he became senior partner of the firm of dry-goods merchants which in 1865 consisted of Marshall Field, Potter Palmer and L. Z. Leiter. His partners having retired in 1881, Field became head of the firm, known thereafter as Marshall Field & Company, with wholesale and retail establishments. The retail department store, which occupies an entire block, with an additional building, or "store for men," in the center of the merchandising district of Chicago, surpasses any other store of its kind in the world, both in size and in equipment. Mr. Field once told an audience of young men they would be successful if they were right in their conclusions fifty-one per cent of the time; he was almost unerring in his own decisions, and this, coupled with an early determination in his career to give good values for the prices he charged, may be considered the keynote of his success.

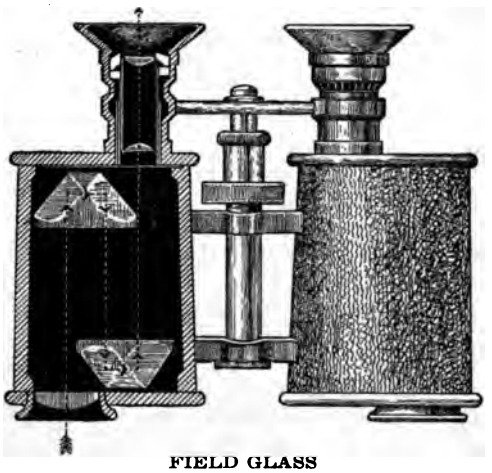
The bulk of Field's great fortune of from $120,000,000 to $150,000,000, largely invested in choice real estate, was left in trust for his two grandsons. About $8,000,000 was willed to the Field Columbian Museum, of which he was the founder. See FIELD COLUMBIAN MUSEUM.

FIELD COLUM'BIAN MUSEUM. In 1894, at the close of the World's Columbian Exposition, held in Chicago, Marshall Field, one of the leading merchants of that city, gave $1,000,000 for the founding of a museum of natural history, to be called the Field Columbian Museum. Material which had been on exhibition during the Exposition was acquired by gift and purchase, and the Fine Arts building of the Exposition, situated on the Exposition site in Jackson Park, was secured as a temporary home for the museum. When Mr. Field died, in 1906, he bequeathed the institution $4,000,000 for the erection of a permanent building, and $4,000,000 as an endowment fund. In 1915 work was begun on this new home, a site having been secured on the shore of Lake Michigan, in the vicinity of Twelfth Street, near Chicago's great business center.

Much of the original material of the museum has been rearranged or discarded. At the present time the museum is divided into these departments are complete and repreogy and zoölogy, and its study collections in these departments are complete and representative. The results of various scientific expeditions sent to different parts of the world are published from time to time, and each year two courses of free lectures are given. Among the important features of the muscum are departmental laboratorics, a library of about

63,000 titles and a well-equipped printing shop. In 1913 arrangements were made whereby the work of the museum could be carried on in connection with the Chicago public schools. The institution is managed by a board of trustees, and is incorporated.

FIELD GLASS, a small instrument for viewing objects at a distance, possessing considerable magnifying power. It is in general use by military men, naturalists, tourists and sportsmen. The field glass most commonly



FIELD GLASS
Cross section shows construction of reflecting prisms. Glasses of this kind are commonly called *binoculars* (having two eyes).

used consists of two telescopes, varying from five to ten inches in length, and having an arrangement of reflecting prisms within the tubes (see illustration). Field glasses are made in four different powers, magnifying respectively three, six, nine and twelve diameters. A glass magnifying six diameters would increase the surface of the object viewed thirty-six (6^2) times, one magnifying nine diameters would increase it eighty-one times, and so on. Glasses with a power of twelve diameters are used especially by naturalists and military officers. See TELESCOPE; OPERA GLASS.

FIELDING, HENRY (1707-1754), a celebrated English novelist and playwright, who has been called by his admirers the father of the modern novel. He was born at Somersetshire, studied at Eton, Leyden and the Middle Temple, London, and was admitted to the bar in 1740. Play-writing was the first step in his literary career, and he is said to have completed at least twenty-five comedies during a period of ten years. *Love in Several Masks* was the first to be produced, and this was soon followed by *Temple Beau* and the *Modern Husband*. These, while clever and amusing, have not the merit and originality of his novels. The latter include his masterpiece, *Tom Jones*, said to be a history of his own life, *Amelia*, *Joseph Andrews*, *Jonathan Wild* and others now less known. His style, while displaying the coarseness of the period, is distinguished by a remarkable descriptive ability and much wit and wisdom.

FIELD'ING, WILLIAM STEVENS (1848-), a Canadian journalist and statesman, premier of Nova Scotia from 1884 to 1896 and Dominion Minister of Finance from 1896 to 1911. During his fifteen-year service as Minister he was largely responsible for the financial policy of the Liberal party, and even after his retirement from the House of Commons in 1911 he remained its chief financial adviser. He personally introduced or was responsible for many of the bills of the Laurier Ministry, including the moderately protective tariff of 1897, noteworthy for its clause granting preference to British manufactured goods. At various times he represented the Dominion on imperial commissions and at important conferences in London, and between 1907 and 1911 negotiated commercial treaties with France, the United States, Germany, Italy and Belgium. He secured the installation of the Ottawa branch of the Royal Mint in 1901, and in 1903 established the penny-bank system. In 1903, while acting temporarily as Minister of Railways and Canals, he conducted negotiations which resulted in the construction of the National Transcontinental Railway. The reciprocity treaty which he negotiated with the United States in 1911 was responsible for the fall of the Laurier Ministry and his own defeat for reëlection to the House of Commons (see CANADA, subtitle *History*).

Fielding was born at Halifax, Nova Scotia, attended the public schools of that city, and in 1864 became a reporter on the Halifax *Morning Chronicle*, of which he later became managing editor. This paper was the leading Liberal organ in Nova Scotia. Fielding was elected to the provincial assembly in 1882, and two years later became premier of the province. He resigned in 1896 to accept election to the House of Commons and a seat in the Laurier Ministry. He declined the honor of knighthood in 1902, and later returned to his old field of journalism in Montreal. G.H.L.

FIELD OF THE CLOTH OF GOLD, a location in the Valley of Andren, between the English castle of Guisnes and the French castle

of Ardres, celebrated for the meeting in 1502 of Henry VIII of England and Francis I of France and their retinues. The conference, which was planned by Cardinal Wolsey to give the two monarchs an opportunity to discuss an alliance against Charles V of Spain, was remarkable chiefly as a magnificent historic pageant, with unimportant political results.

FIFE, a six-holed wind instrument resembling the flute and piccolo, but differing from the latter in that it has no keys. Its compass is two octaves, and it is pitched in various keys. Its clear, shrill sound is produced by blowing

A FIFE

into a hole near the closed end of the tube. The fife is of ancient origin, and has always held its place with the drum as an appropriate instrument for military music. One of the most inspiring paintings is *The Spirit of '76,* picturing a grandfather, son and grandson, playing on snare drums and a fife, leading the tattered American Continentals in battle.

FIFTEEN DECISIVE BATTLES. Of all the many great battles in the history of the world, there had been, down to the year 1850, in the opinion of Sir Edward Creasy, fifteen which actually changed the course of history. In his *Fifteen Decisive Battles of the World,* published in 1851, he described these and pointed out the special significance of each. They are the following:

(1) **Marathon** (490 B. C.). In this battle the Greeks, with Miltiades as their chief leader, defeated the hosts of Darius I, the Persian king. These Asiatic hordes had been regarded as unconquerable, but this battle proved the superior ability of the Western armies and turned back the tide of Asiatic civilization which had been creeping steadily westward. See MARATHON.

(2) **Syracuse** (413 B. C.). The expedition of the Athenians in Sicily ended most disastrously, and the extension of Greek rule to the westward was checked. Because of this Athens lost its dominant position in Greece, and the way was prepared for the successive dominations of Sparta, Macedonia and Rome.

(3) **Arbela** (331 B. C.). Alexander the Great defeated Darius III of Persia, and made it clear that European and not Asiatic civilization was to control the future. See ALEXANDER THE GREAT.

(4) **Metaurus** (207 B. C.). Hasdrubal, brother of Hannibal, the Carthaginian foe of Rome, had collected a large army which he was leading to the help of his brother. At the Metaurus River he was defeated and his army was destroyed by the Romans, and Hannibal's withdrawal and the overthrow of Carthage followed. See PUNIC WARS.

(5) **Teutoburg Forest** (A. D. 9). Here Arminius, a German chieftain, defeated and practically destroyed a Roman army under Varus, thus making impossible the subjugation of Germany by the Romans.

(6) **Chalons** (451). The Huns under Attila were sweeping over Southern Europe, blotting out the civilization of centuries, but at Chalons they were routed by the Romans and Visigoths, and a large part of the continent was saved from devastation at their hands.

(7) **Tours** (732). Here Charles Martel (the "Hammer") defeated the Saracens and turned back the tide of Mohammedan invasion which was threatening to sweep over Europe as it had swept over Western Asia and Northern Africa. But for this battle Christianity in Europe might have been blotted out.

(8) **Hastings** (1066). This was the battle from which so much in English social, political and literary life dates—the battle in which William the Conqueror overthrew Harold. From this time on the Normans and not the Saxons were dominant in England until the two peoples merged into one.

(9) **Orleans** (1429). France was in a position where one more defeat would have subjected it entirely to England, but Joan of Arc compelled the English to raise the siege of Orleans and so made possible the coronation of the French king and the gradual wresting of France from the grasp of England. See JOAN OF ARC.

(10) **The Spanish Armada** (1588). This huge fleet had as its object the invasion of England and the restoration of Catholicism there. Its defeat saved England and its colonies to the Protestant faith. See ARMADA.

(11) **Blenheim** (1704). In his poem on the *Battle of Blenheim,* Southey writes:

> "But what good came of it at last?"
> Quoth little Peterkin.
> "Why, that I cannot tell," said he;
> "But 't was a famous victory."

But Creasy gives clearly enough the significance of this battle; it checked the ambitious schemes of Louis XIV of France, and saved Europe from the possible domination of that country.

(12) **Pultowa** (1709). By his defeat of Charles XII of Sweden in this battle, Peter the Great not only made clear the fact that it was Russia and not Sweden that was to control the destinies of Northern Europe, but established the Russian Empire more firmly and opened it up to the influences of European civilization.

(13) **Saratoga** (1777). Here the American colonists, under Gates, defeated the British under Burgoyne. Perhaps the most important result of the victory was the determination of France to aid the Americans—an event which proved practically the turning-point in the Revolutionary War. See REVOLUTIONARY WAR IN AMERICA.

(14) **Valmy** (1792). Had the French been defeated in this battle by the allied Prussians and Austrians, the French Revolution would probably have died out, but this early victory encouraged the revolutionists and they persisted until their demands were granted. See FRENCH REVOLUTION.

(15) **Waterloo** (1815). Napoleon was finally defeated by the allied forces under the Duke of Wellington, and Europe was freed from his ambitious demands. See NAPOLEON I.

Later Crises. Many of the battles named above all historians agree in regarding as turning-points, but as to others opinions differ. Later battles, too, must rank as equally decisive, those of Gettysburg (1863), Manila (1898) and Mukden (1905) having been particularly important. It is probable that some future historian, looking backward, may count the Battle of the Marne, the Battle of Verdun or the Battle of the Somme, or some other conflict in the great War of the Nations among the most decisive struggles the world has ever seen. See WAR OF THE NATIONS.

Sir Edward Shepherd Creasy (1812-1878) is remembered chiefly for the book discussed above, though he wrote several other historical works not unworthy to rank with it. His *Historical and Critical Account of the Several Invasions of England, History of the Ottoman Turks* and *Imperial and Colonial Constitutions of the British Empire* show a breadth of learning and true historical judgment. Creasy was born at Bexley, in Kent, studied at King's College, Cambridge, practiced law, and in 1860 went to Ceylon as chief justice.

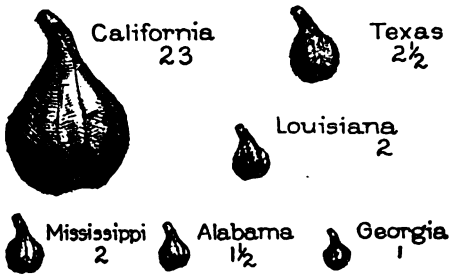
FIG, commonly seen in its dried state as a light or dark brown sugary pulp with slightly tough exterior, filled with little golden edible seeds. It grows on trees about fifteen or twenty feet high. The leaves are deeply lobed, and the so-called fruit, when ripe, is pear-shaped, green, yellow, red or blue-black. It is

THE FIG

Branch of the tree; and fruit, showing cross section.

[redacted] with sugar and cream, also when [redacted] reserved, or in a dried state. Figs [redacted] nourishing dried than when fresh, [redacted] as nutritious as dates. Stewed, [redacted] re nourishing than apple sauce.

Figs have been known since the earliest times, references to them occurring frequently in the Bible, as "Do men gather figs from thistles?" Every ancient householder was supposed to cultivate at least a few trees, and from this



Figures Represent Millions of Pounds

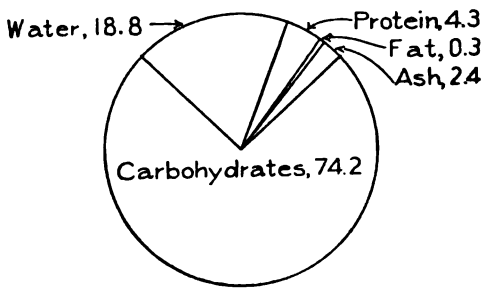
A YEAR'S PRODUCTION

The fig industry in the United States is yearly on the increase.

custom arose the expression "under his own vine and fig tree," denoting a home.

There are over one hundred kinds, most of them grown in the countries around the Mediterranean Sea, but certain varieties are also cultivated in the Southern and Western states of America, especially in California.

Smyrna Figs. The successful raising of the Smyrna fig, the most delicious variety, depends upon the presence of the fig-wasp, a parasitic insect. A fig, unlike most fruits, does not develop from a flower, but is itself the container of the flowers, which are crowded thickly on its inner surface. At the bases of the flowers of the inedible, wild capri-fig, the fig-wasp's eggs are laid, and within the fig the new generation of wasps hatches and develops.



FOOD VALUE OF DRIED FIGS

The fuel value of figs is about 1,500 calories per pound. This is one-half greater than that of sirloin steak, nearly equal to that of beans, and almost three times that of peas.

If a branch from the capri-fig tree is suspended in a Smyrna tree, the female wasp, crawling about within the figs in search of a place to lay her eggs, will distribute the pollen of the male flowers of the fig from which she

came to all the female flowers of the Smyrna fig. But the Smyrna flowers are not suitable for hatcheries, and the wasp returns again to the wild fig without depositing her eggs. Thus fertilized with the pollen of the wild fig, the Smyrna fruit grows large and sweet; otherwise, though the trees bear heavily, the figs will be lean and unattractive. A California fruit grower tried more than ten years to introduce the fig-wasp from the Orient; his success has made the California fig equal the original Smyrna fruit in quality.

The annual average output of figs in California is now in excess of 23,000,000 pounds per year (10,000,000 pounds after drying). Figs are among the most expensive of dried fruits, and are valued at $200 to $400 a ton in the great city markets. C.H.H.

FIGARO, *fe ga ro'*, a type of character of clever adroitness, first introduced on the French stage about 1785, by Beaumarchais, as the hero of his comedies. In the *Barber of Seville* he is a barber, cunning and witty; in the *Marriage of Figaro* he is a clever valet and finally outwits everybody. The dramatic character of Figaro seized the popular imagination of the day and became the name for daring, cleverness, roguery and intrigue. One of the principal journals of Paris, founded in 1826, was named *Le Figaro;* it had Paul La Croix, Jules Sandeau and George Sand among its contributors. This journal was suspended in 1833 but was revived by Willemessant in 1854 and is yet in existence.

FIG'URE OF SPEECH. When a great author writes "Lend me your ears," or the enthusiastic youth exclaims, "You're a brick, dad!" neither means literally what he says, and yet both express their meaning more forcibly than would have been possible in the expression, "Listen to me," or "You are a very satisfactory parent." The use of words in any but their literal meaning is known as a *figure of speech.* Frequently figurative expressions are very beautiful; they form the chief ornaments of poetry, as when the Psalmist chants "The Lord is my rock and my fortress," or Shelley sings how—

> That orbéd maiden, with white fire laden,
> Whom mortals call the moon,
> Glides glimmering o'er my fleece-like floor
> By the midnight breezes strewn.

Figures of speech are more commonly used than one would believe who has not studied the question. Such oft-heard expressions as "He dropped his eyes," "the raging sea," "pretty as a picture," "he addressed the chair," "all hands on deck" and "a speaking likeness" are figures as truly as are the more elaborate ones of the poet. The chief kinds of figures—metaphor, simile and metonymy—are treated in separate articles in these volumes.

The figures referred to above are really only one class of figures of speech, and are more exactly called figures of rhetoric. In addition there are two other classes which are of grammatical form rather than of thought, and are known as figures of etymology and figures of syntax. The former concern themselves with the forms of words and consist largely in the use of such elision or contractions as *o'er* for *over, won't* for *will not* and *'tis* for *it is;* while figures of syntax are variations in sentence construction. Figures of syntax are in common use, especially the form which consists in leaving out a word or several words which are really essential to the grammatical completeness, the object being an increase in forcefulness. *Hats off!* for instance, is more effective than *Take your hats off; Here!* than *Come here!* and *Down!* than *Sit down.* A.MC C.

FIJI, *fe'je,* **ISLANDS,** Great Britain's most important possession in the South Pacific Ocean. There are about 250 islands, only eighty of which are inhabited. They cover a total area of 7,435 square miles, and are of

FIJI ISLANDS

volcanic origin, with peaks rising to about 4,000 feet above the sea. Streams are abundant, and the soil is very fertile, producing great quantities of fruits, corn, tobacco and sugar cane. Cocoanut palms abound, the dried kernels, called copra, being the principal export (see COPRA). The chief occupation is agri-

culture, though the fisheries are important. The only wild animals native to the islands are rats, but domestic animals of all kinds have been introduced.

Until recent years the inhabitants, who were formerly notorious cannibals, adhered to their own pagan religion, the principal feature of which was ancestor worship. So deeply-rooted was cannibalism that for human flesh the Fijians would sacrifice parents or children. The eating of "long pig," as human flesh was called, was a religious duty; so whether the victim happened to be friend or foe was of little importance. The greater number of the natives have now embraced Christianity and have proved themselves quick in adopting civilized manners and customs. Only two of the islands are of fair size, Viti Levu, on which stands the capital, Suva, and Vanua Levu. The islands are administered by a governor and council, the native chiefs being given a voice in legislative affairs. Population in 1911, 139,541.

FILIBUSTERS, *fil'i bus terz,* a name handed down from the buccaneers, or seventeenth century piratical rovers. The term was first applied in America to the adventurers in the middle of the nineteenth century, who organized expeditions in the United States, in defiance of international law, to gain control of Cuba and some of the Central American states. In 1853 William Walker of Tennessee made raids into Nicaragua and fomented revolutions, but he was captured in Honduras, court-martialed and shot.

Filibustering expeditions also sailed from New Orleans to Cuba, led by Narcisco Lopez, but they all came to naught. Such expeditions have become exceedingly rare during the last quarter of a century, the last to be called by that name being the Dr. Jameson raid, which in 1895 tried to overthrow the Boer government in South Africa.

The term has come into vogue in more modern times to designate legislative members who are in the minority, who try by making irregular parliamentary and dilatory motions to prevent the adoption of measures favored by the majority. See WALKER, WILLIAM; JAMESON, LEANDER STARR.

FILL'MORE, MILLARD (1800-1874), thirteenth President of the United States and the second Vice-President to succeed to that high office through the death of the President. He was therefore one of the so-called "accidental Presidents." When Fillmore was nominated for the Vice-Presidency he was known as a prominent Buffalo lawyer; he had served with distinction in the House of Representatives, and he was one of the Whig leaders in New York state. No one, least of all he himself, claimed that he was a brilliant lawyer or statesman. He was hard-working and conscientious, always doing his duty as he saw it and asking no particular credit therefor. This temperament has laid him open to the charge of being uninteresting. He was never spectacular or erratic; he was, in fact, the type of man who makes an excellent executive, but never rises to fame by accident.

Even his enemies admitted his modesty and sincerity, but a simple act, the signing of the Fugitive Slave Law of 1850, cost him his popularity. He had the peculiar faculty of detaching himself from the burning issues of the day, and of viewing them in calmness and without passion. In a sense, therefore, it is true that he had little to do with the important events of his administration, but it must not be forgotten that he did impress his personality on the men with whom he came into contact. Men like Clay and Webster were great admirers of Fillmore, and Clay on his deathbed recommended the nomination of Fillmore in 1852 for the next Presidential term.

Early Hardships. The casual observer who watched Fillmore grow to manhood would scarcely have suspected that here was a boy who was destined to be President of the United States at one of the most critical periods in

its history. At the time of his birth, on February 7, 1800, his father and mother were living on a little clearing in Cayuga County, N. Y., within the limits of the present village of Summer Hill. Through some flaw in the title the father lost his farm, and was obliged to lease an uncleared tract of poorer land some miles distant. On this new farm Millard worked until he was fourteen. He helped to clear off the timber, and in many ways did the work of a man. As the poverty of the family seemed to prohibit a professional career, the boy was apprenticed to a maker of carding wool and cloth. He was the youngest apprentice in the shop and was so brutally treated that on one occasion he threatened his employer with an ax. In the next year he found a new master, with whom he stayed four years. In 1819, when he still had two years of his apprenticeship to serve, he bought his release for $30 and made his way to Buffalo.

Up to that time young Fillmore had acquired practically no education. He had attended school occasionally for a month or two at a time, but in the intervals nearly forgot what he had learned. His father owned only two books, the Bible and a book of hymns, and young Fillmore himself did not buy his first book, a small English dictionary, until he was nearly nineteen. In spite of this lack of early training he determined to study law. He arranged with a retired lawyer to give his services in the law-office in return for his board and a chance to study. He earned a little money, too, by teaching school and by working in spare time in the Buffalo post office. In 1823, although he had not yet completed the usual course of study, he was admitted to the bar. His practice grew slowly, but in time his ability was recognized, and in the late "thirties" and the "forties" there was hardly an important case in Western New York in which he was not engaged.

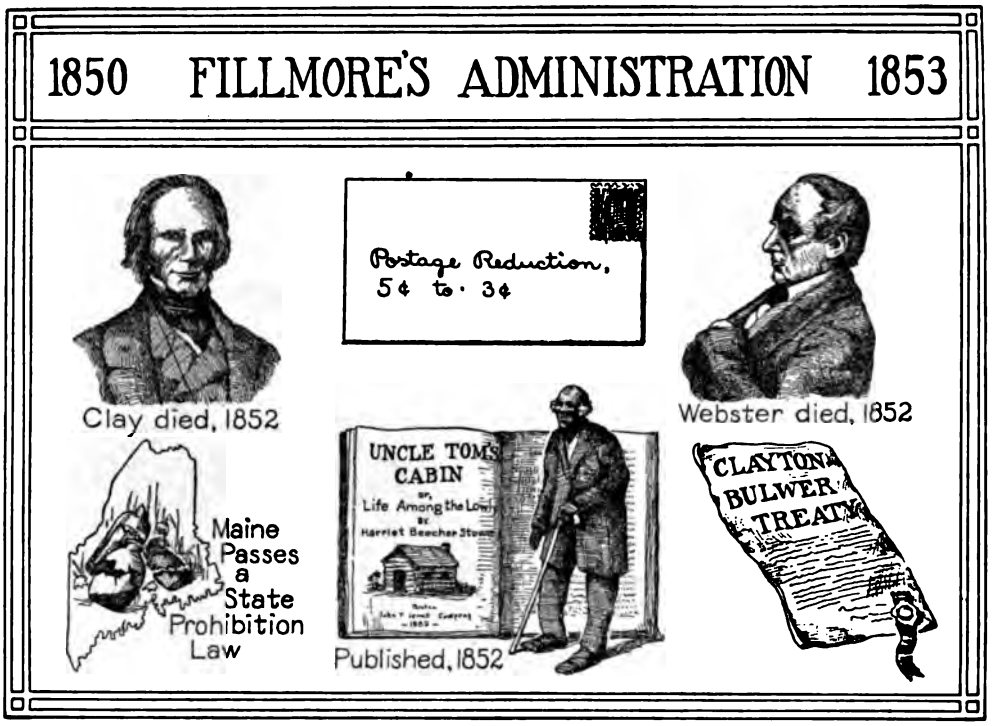
Political Career. Fillmore's political career began with the birth of the Whig party, and came to an end when that party disintegrated (see WHIG). Fillmore was always a Whig at heart; he believed in the necessity of compromise, and when the time for compromise passed he could no longer lead. He was elected to his first public office, that of representative in the New York legislature, in 1828, and served three terms, during which he distinguished himself chiefly by securing the passage of a law abolishing punishment for debt in New York.

He then served in the national House of Representatives from 1833 to 1835 and again from 1837 to 1843, when he declined renomination. In Congress he was one of the leaders of the opposition to Jackson and Van Buren,

MILLARD FILLMORE

and during his last term, when the Whigs were in the majority, was chairman of the Committee on Ways and Means, which then not only raised money but made the appropriations. Fillmore opposed the annexation of Texas as slave territory, advocated a protective tariff and internal improvements, desired Federal prohibition of the slave trade between the states, and forced the total abolition of slavery in the District of Columbia. Perhaps his most important work in Congress was connected with the tariff law of 1842, of which, as chairman of the Ways and Means Committee, he was the chief author (see TARIFF). He retired from Congress in 1843, was the unsuccessful Whig nominee for governor of New York in 1844, and in 1847 was elected comptroller of the state. A year later he was nominated for the Vice-Presidency by the Whigs, General Zachary Taylor being the candidate for President, and was elected. For details of the election, see TAYLOR, ZACHARY.

Fillmore's return to Washington as Vice-President occurred at a time when Congress was in the midst of a heated controversy involving the extension of slavery. He speedily reversed the precedent set in 1826 by Calhoun, who stated that the Vice-President had no right to call Senators to order for breach of



decorum. Fillmore, however, with the Senate's approval, kept strict order and presided with notable impartiality. During all the exciting sessions in which Clay's compromise measures were discussed he presided with such fairness that nobody on the floor of the Senate had knowledge of Fillmore's personal opinion. While the discussion of Clay's proposals (see COMPROMISE OF 1850) was at its height, the sudden death of President Taylor, on July 9, 1850, called Fillmore to the highest office in the United States.

Administration of Fillmore (1850-1853). Immediately after Taylor's death his Cabinet resigned, and was replaced by Daniel Webster as Secretary of State, Thomas Corwin as Secretary of the Treasury, and others chosen by Fillmore. Webster, while he lived, added much strength to the administration; he died in 1852, and was succeeded by Edward Everett. Webster was the last of the great triumvirate who played the chief parts in American history for over thirty years; Clay died only a few months earlier, and Calhoun had passed away in March, 1850. Each of these men made his last great speech in favor of the Compromise of 1850, though Calhoun was so ill that his speech was read to Congress [illegible] Fillmore promptly signed the various bills which were included in the Compromise, but his signature on the Fugitive Slave Law lost him the support of the Northern Whigs. Of his honest belief, however, that the Compromise was the only way to preserve the Union, there never was doubt. The publication of *Uncle Tom's Cabin* in 1852 did much to crystallize anti-slavery sentiment in the North.

Besides the Compromise of 1850 the important events of Fillmore's administration were few. Fillmore was opposed to the agitation for the annexation of Cuba to the United States, and in 1851 attempted to prevent a filibustering expedition to that island. The Whigs were in the minority in both houses of Congress, and most of the laws which Fillmore suggested failed to meet approval from the legislators. The Senate, nevertheless, approved the treaty with Japan which was the result of Perry's expedition (see PERRY, MATTHEW C.). Fillmore laid the cornerstone for the addition to the Capitol building and also secured a reduction in the rates of postage. In foreign relations Fillmore pursued the policy of non-intervention, although Webster, his Secretary of State, was instrumental in securing freedom for Louis Kossuth, the Hungarian patriot. Other events of more than local interest were

Outline and Questions on Millard Fillmore

Outline

I. Years of Preparation

(1) Birth and parentage
(2) Lack of schooling
(3) Years of apprenticeship
(4) Law study
(5) Rise in legal profession

II. Early Political Career

(1) In New York legislature
(2) In national House of Representatives
  (a) Chairman of Committee on Ways and Means
  (b) Part in slavery struggle
  (c) Tariff of 1842
(3) Comptroller of New York
(4) Election to Vice-Presidency
  (a) Fairness and impartiality in Senate
  (b) Death of Taylor

III. Administration

(1) Government affairs
  (a) Compromise of 1850
  (b) Aid for Kossuth
  (c) Reduction of postage rates
  (d) Perry's expedition to Japan
  (e) Effects of Fugitive Slave Law
(2) Internal and local affairs
  (a) "Underground railway"
  (b) *Uncle Tom's Cabin*
    1. Effect in crystallizing anti-slavery sentiment
  (c) Prohibition in Maine
  (d) Visit of Kossuth
  (e) Deaths of Clay and Webster
  (f) Pacific railways begun
(3) Election of 1852
  (a) Candidates
  (b) The issue
  (c) The result
    1. Small electoral vote secured by Fillmore

IV. Summary

(1) Retirement and death
(2) Character

Questions

What other Presidents did Fillmore resemble in the circumstances attending his boyhood days?

What was Fillmore's chief work as chairman of the Ways and Means Committee of Congress?

What would it have cost at the beginning of this administration to send a letter from New York to Boston? At the end?

What act of Fillmore's lost him his popularity and possible reëlection? What was his motive in performing it?

What did the President believe would be the most satisfactory method of dealing with the negro question?

How did a book published during this administration play a very real part in the history of the country?

Why is Fillmore called an "accidental President? To what other Presidents does the name apply?

How many books was young Millard familiar with in his boyhood? What was the first book he ever purchased?

How did he in his position as presiding officer of the Senate reverse the policy of his predecessors?

the passage of the first prohibition law by Maine in 1851; the beginning of the construction of Pacific railways, and reduction of letter postage from five cents to three cents.

In Retirement. In 1852 Webster and General Winfield Scott were both candidates for the Whig nomination for President, and Fillmore was anxious for a renomination. Scott was chosen, but was defeated in the election by Franklin Pierce, the Democratic candidate, who thus became Fillmore's successor. Fillmore was nominated for President in 1856 both by the Whigs and by the Know-Nothings, or American party. Though he received nearly 900,000 votes, compared to 1,300,000 for Fremont and 1,800,000 for Buchanan, he carried only one state, Maryland, which gave him eight electoral votes.

During the rest of his life he continued to take an active interest, but no part, in politics. For twenty years he occupied a unique position in Buffalo, his home city, of which he was the most distinguished citizen. His death occurred unexpectedly on March 8, 1874, and he was buried in Forest Lawn Cemetery. W.F.Z.

FIL'TER, a device containing a porous substance for straining solid particles or impurities from a liquid. The material for filtering may be paper, cloth, charcoal, unglazed porcelain or other similar media. The name is derived from the Latin *filtrum,* meaning *felt,* which was the material first used for the purpose. Previous to the nineteenth century if a filter made water clear that was all that was required, but modern sanitary science discovered that some filters did not remove germs and bacteria, and more efficient means were resorted to in order to purify water for domestic purposes. The filters now in general use are cases filled with charcoal, sand, powdered glass or coal cinders. Charcoal, in particular, is an excellent filter, as it absorbs noxious gases. Impure water enters at the top of this device and flows slowly through the purifying substance, which absorbs the objectionable matter. A home-made filter may be as effective as one that can be purchased.

All water for drinking purposes, except from deep wells where drainage is perfect, or from springs, should be filtered. The best method in cities is to have a filter attached to the pipes of the house supply so as to insure filtered water running from all the faucets. In the absence of filters, if the water is thought to be infected, it should be boiled, allowed to cool in an open vessel and frequently stirred

The latter process restores part of the oxygen which was lost through the process of sterilization. The water supply systems of cities frequently have filters acres in extent, having the bottom filled with sand and charcoal through which the water percolates and becomes purified before reaching the consumer.

FINCH, a general name broadly applied to that largest family of birds, the seed eaters, to which about one-seventh of all the birds belong. Many of them are beautiful songsters. Though most of the species are sober in coloring, some are very brilliant; and there is a wide range of variation. The chief distinguishing feature of all individuals of this family is the sharply-pointed, conical bill, made strong for the crushing of seeds and hard objects. There are about 550 species, and they are found in all parts of the world except Australia. In the United States and Canada they are especially abundant, and are represented by the twittering sparrow, the sweet singing canary, and by the chaffinch, goldfinch, bullfinch, bunting, crossbill, grosbeak, linnet, snowbird and numerous others. See the article BIRD for lists of birds described in these volumes.

FINDLAY, OHIO, the county seat of Hancock County, a city known for its extensive yield of natural gas, is situated in the northwestern part of the state, on the Blanchard River. Toledo is fifty miles north, Sandusky is fifty-nine miles northeast, and Columbus is eighty-eight miles southeast. Five lines of railways enter the city—the Cincinnati, Hamilton & Dayton; the Cleveland, Cincinnati, Chicago & Saint Louis; the Lake Erie & Western; the Toledo & Ohio Central, and the Findlay, Fort Wayne & Western. Three interurban lines connect with cities north, east and south. In 1916 the population was 14,858. The area of the city is a little less than eight square miles.

Findlay is located in the great natural gas and oil fields of Ohio, and the surrounding country is rich in agricultural products. Rich beds of clay and large deposits of gravel, sand and building stone are also found in the vicinity. Important among the manufacturing establishments are those producing brick and tile, boilers, pottery, automobiles, traction ditchers, gloves, beet sugar, electric insulators, shoes, furniture and carriages. There are also machine shops and foundries, bridge works, lime [illegible] nd oil refineries. The build- [illegible] a $50,000 Federal building, [illegible]'s' Home, and two public school buildings, erected in 1915 and 1916 at a cost of $300,000. The city has a business school, a library and Findlay College (Church of God), the latter opened in 1886.

The city was first settled in 1813 and was incorporated in 1837. It was named in honor of Colonel James Findlay, who built a fort here in 1812, and who served during the War of 1812 under General Hull.

FINE, a punishment imposed by judicial authority on a person convicted of a misdemeanor or a more serious crime. In case of a misdemeanor the amount of the fine is usually left to the judgment of the court, but the penalty for greater offenses is imposed by statute, which names maximum amounts which may be assessed. In case a convicted person is unable to provide the amount of fine imposed he must suffer imprisonment for such time as the court may direct. An accused person also has the right to appeal to a higher court if he is fined an amount which he thinks is excessive, as too heavy or extreme fines are forbidden by the Constitution of the United States (Amendment VIII), which declares, "Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted." See MISDEMEANOR.

FINE ARTS, the arts of man which minister not to his material necessities or convenience but to his love of harmony and beauty. Architecture, sculpture, painting, music and poetry are generally considered the five principal, or greater, fine arts.

Poetry is the most complex of all the fine arts in its resources, because it utilizes all the other arts and all the phenomena of nature and experiences of life. Music is the purest of the fine arts, because the sources of pleasure in it are purely artistic; it tells no story, represents no fact, but simply gratifies the sense of rhythm and harmony and so gives pleasure. In the modern use of the term the fine arts are only the imitative arts, which appeal to us through the eye—and the term, therefore, is often restricted to painting and sculpture. That the interest of Americans and Canadians in the fine arts is growing is evidenced by the increasing numbers of people always to be found in the art galleries and at musicales.

To Hegel, the famous German philosopher, architecture was the symbolic art appropriate to ages of obscure and struggling ideas. Sculpture was the classical art appropriate to ages of clear and self-possessed ideas, and char-

acteristic of the Greek and Roman periods. Painting, music and poetry were the romantic arts, appropriate to ages of complicated and overmastering ideas, and characteristic of modern humanity in general.

Related Subjects. The reader is referred to the following articles in these volumes:

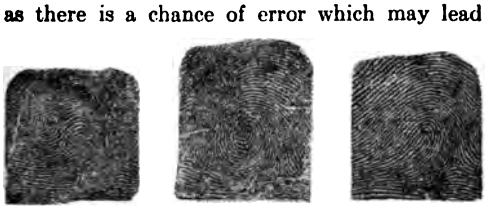
Architecture	Painting
Arts and Crafts	Poetry
Music	Sculpture

FIN'GAL'S CAVE, an interesting natural grotto in the island of Staffa, seven miles west of Mull, Scotland, which is supposed to have been hollowed out by the action of the waves on volcanic deposits of lava. It is formed of

ENTRANCE TO FINGAL'S CAVE

basaltic columns, extends 227 feet inward, and its entrance arch is 66 feet high. It is considered one of the most picturesque natural formations in the world, and is believed to have been named after Fingal, a legendary Gaelic hero.

FINGER PRINT IDENTIFICATION. In the art of identification of criminals sure methods have long been sought. The Bertillon System (which see) is not absolutely perfect, as there is a chance of error which may lead



FINGER PRINTS

At left, double, or twinned loops; in center, a whorl; at right, simple loop. In all the world there are no other thumb impressions which will register exactly the same forms as the above.

to the punishment of the innocent. The measurements which formed the basis of the Bertillon method have been supplemented by finger prints in such a way that a record may be kept which renders it difficult for a criminal, once his finger print has been taken, to escape later identification, if captured.

The use of finger prints was common among Eastern nations several centuries before the Christian Era. The lines on the fingers and thumb vary in different individuals, but these lines on any one individual do not change in their general pattern during lifetime, and once recorded, can always be compared with fresh impressions. It is believed to-day that no two finger prints are exactly alike. In making a record for preservation the impression, or finger print, is taken by placing the fingers or thumbs on a sheet of glass covered with India ink. The fingers are then pressed upon white paper. If a criminal leaves a finger print on glass, or any other smooth surface on which the heat and natural moisture of the hand would cause such impression, it may be photographed and compared with those on record. Finger print identification is now largely relied on by the police of all countries.

FINIAL, *fin'i al,* in architecture, from the Latin *finis,* meaning *end,* is a finishing ornament at the top of pinnacles, spires, gables or other pointed structures. Finials are found in Greek architecture and are still extensively employed. In ecclesiastical architecture an elaborate finial of metal work surmounted by a cross is commonly used. In Mohammedan countries it forms a foundation for the crescent. Finials reached their most artistic stage in the latter part of the twelfth century. Many old English churches contain splendid examples in the decorations of the ends of pews.

FIN'LAND, the most northwesterly division of Russia, called by its own people "the land of lakes and fens." With good reason is it thus named, for over eleven per cent of its surface is covered with lakes, and an even larger proportion with bog and marsh. It has Norwegian Lapland on the north, Russia proper on the east, the Gulf of Finland on the south, and the Gulf of Bothnia and Sweden on the west. Within its borders is included a large part of Russian Lapland, and its total area is 144,255 square miles, almost that of the state of Montana.

The People. The population, which is increasing steadily and in 1911 numbered 3,154,284, is largely made up of Finns, although about twelve per cent are Swedes, and there are a few Russians and Lapps. The Finns are a strong, well-built people, distinguished by

their round heads, low foreheads, fair hair and blue eyes. There is in their appearance something akin to the Mongolians, to whom they are racially related, for their features are rather flat, their cheek bones prominent and their eyes set somewhat obliquely. Mentally and morally they are well advanced and show a keen interest in education. Over ninety per cent of the adult population, it is estimated, can read and write, and ninety-seven per cent of the children of school age receive regular instruction. While they are a clean, moral people, devoted to the Lutheran religion, the Finns have nevertheless, until recent years, suffered from a fondness for strong drink, but temperance principles have made great headway. Particularly noteworthy is their love for freedom; they never have been forced to submit to the system of serfdom which is the curse of other parts of Russia. All things considered, Finland is as yet the freest part of the Russian Empire.

The Finns speak a language which is related to those of the Lapps and the Hungarians —a beautiful, flexible tongue, so highly developed that it can express the finest shades of meaning. There are various works written in it, some old and some modern, but the greatest of these is the *Kalevala,* the famous folk epic from which Longfellow took the meter for his *Hiawatha.*

The Country. This "Land of the Thousand Lakes" is for the most part a low-lying country, which ages and ages ago lay under the great sheet of ice that covered all Northern Europe (see GLACIAL PERIOD). Here and there hills and mountains rise as high as 4,000 feet above the sea, and all of these but the tallest show the rounding, smoothing effect of the glacial ice-sheet. The low coast is deeply indented, and the thousands of little rocky islands with which the shores are studded make navigation difficult and dangerous. It was the ancient glaciers which carved the beds for the labyrinth of lakes, many of which are of considerable size. The largest of them, except Lake Ladoga, of which only the northern part belongs to Finland, is Saima, which has an outlet into Ladoga over the Imatra Falls, the finest and most beautiful rapids in Europe.

A very large part of the land surface is covered with forests, and only about three per cent is available for agriculture. The soil on this cultivable area is fertile, however, and during the short, hot summers produces large crops of wheat, rye, oats and potatoes. There is an abundance of pasture land, so the dairy industry is of importance, but much of the foodstuff of Finland must be imported. Iron ore, copper and granite are the only mineral products worthy of mention; and manufacturing, despite the enormous motive-power latent in the rapid streams, has had no great development. Flour-mill products, lumber and timber products and textiles are the chief manufactures.

LOCATION MAP

History and Government. The Finns, or, as they call themselves, the Suomi, lived as independent tribes up to the twelfth century, when the Swedes began campaigns which resulted a century later in the establishment of Swedish domination. Christianity was introduced, and when Sweden became Lutheran the new faith was passed on to Finland. Russia had long cast envious eyes on this Swedish possession which was so close to the Russian borders, and more than once waged war for it, but not until 1809 was the grand duchy actually conquered from the Swedes. Every czar of Russia since then has taken a solemn pledge to preserve the laws and liberties of Finland, and in the main the pledge was well kept until 1897, when the Russification of the country was begun. Much in this direction was accomplished, but in 1905 a popular rising occurred in Helsingfors, the Finnish capital, which for a time secured the

ome-rule privileges. These, however, were decidedly lessened by a law of 1910 which into the hands of the Russian Duma all ers which affect Russia and Finland to- r.

land is a grand duchy, with the czar of ia as its grand duke. It has its Diet, or ament, which consists of one chamber of d members, women possessing the right te and to hold office on equal terms with

The chief executive officer, and the sentative of the grand duke, is a governor- al, who is appointed by the emperor and ially a Russian.

f of Finland. This is a great eastward- hing arm of the Baltic which juts into estern borders of Russia, having Finland e north and the Russian governments of grad and Esthonia on the east and south. s a length of more than 250 miles, and a th that varies from ten to eighty miles, entral portion being the widest. Into it y the waters from lakes Ladoga and a, but so steady is the outward flow that ulf is only slightly salt. Comparatively w, dotted, especially along its northern s, with rocky islands, and in the winter d with ice, it offers difficulties to naviga- yet there are several ports on its coasts, ich the most important are Helsingfors, g and Kronstadt. A.MC C.

SEN, NIELS RYBERG (1861-1904), a Dan- hysician and scientist, the discoverer of ethod of curing deep-seated skin diseases, upus, with rays of light. He was born in ö, in the Faroe Islands, studied medicine eykjavik and Copenhagen, and became nstrator of anatomy in the university in tter city. His experiments began in an room of the surgical academy in Copen- . In 1893 he published an article on *Influence of Light on the Skin* which at- d immediate attention. After patient ch he asserted that smallpox victims be cured without scars by filtering the of the room through red glass.

develop the positive element of the cure he employed either the light of the r that of an electric arc lamp of 40,000 e power, known as a high-power Finsen

Financial support was given him by the h government to establish a Medical Institute at Rosenvaenget, near Copen- , and there many cases have been cured were considered hopeless. Professor Fin- ceived the Nobel medical prize in 1903. When he died nearly every European ruler was represented at his funeral, and leading scientists paid him high honors. His system of treatment is used by physicians for the cure of eczema, acne, tuberculous glands and kindred ailments.

FIORD, or **FJORD,** *fyord,* a long, narrow, irregularly-shaped inlet of the sea. The term is of Scandinavian origin, and applies especially to the remarkable indentations on the coast of Norway. They seem to have been made

FIORDS IN TWO CONTINENTS
Only in Scandinavia is the name *fiord* applied to these indentations of shore lines.

by glaciers long, long ago. Norway's fiords are a source of joy and wonder to tourists, bordered as they are with steep, rocky walls, with here a thickly-wooded spot, there a foaming cascade tumbling down, and perhaps down below, edging it all, a stretch of fine, fertile country. The Sogne Fiord, 112 miles long and in places 4,000 feet deep, is the largest; Hardanger Fiord is remarkable for its beauty.

Similar inlets of the sea are found in Maine, British Columbia and Southern Alaska. Such inlets on the coast of the British Isles are known as *sea locks* and *firths.* The scenery of the fiords of the southwest coast of the South Islands of New Zealand is very imposing.

FIR, a handsome, cone-bearing evergreen tree, closely related to the pine and resembling the spruce. The fir tree is cone-shaped, and in young specimens the lowest branches touch the ground. The leaves, or needles, are flat, dark green above and light green below, growing in rows on opposite sides of the branches.

There are a number of species of fir found in cold climates and in many high altitudes throughout the eastern and western hemispheres. In America, from Hudson Bay to Virginia and westward to the Great Lakes and Minnesota, the short-lived *balsam fir,* growing to a height of about thirty feet, is common. The branches furnish a favorite bedding for campers. Its bark furnishes oil used in medicine to heal and soothe, and specially prepared *Canada balsam* (which see) is used for mounting microscopic specimens. The fresh, fra-

grant leaves are used to stuff pillows; the odor is very soothing to invalids.

The *silver,* or *lowland,* fir is a gigantic tree, often growing as high as 300 feet. It is abundant in the Pacific states and furnishes

THE BALSAM FIR

Form of the tree and a branch showing needles and cones.

a soft, white wood that is used for boxes, barrels and some interior finishing. The *red fir* of the same region is very much like the silver fir. About 2,000,000 board feet of fir timber, worth from $18,000,000 to $20,000,000, are cut yearly on the Pacific coast.

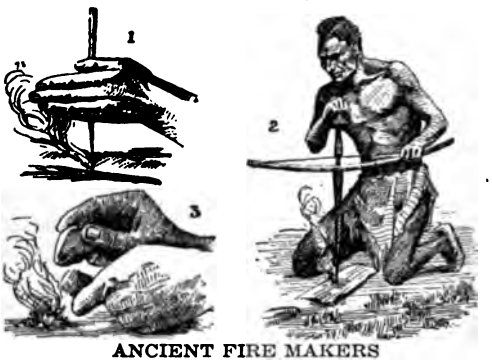
FIRE. Fire is visible heat, resulting from the chemical combination of certain substances with the oxygen of the air. Heat and light are among the results of this union. Although they are perfectly combustible, such substances as wood and coal will not take fire of themselves; that is, they will not combine with oxygen until they are heated, and they will not continue to burn if oxygen be not present. This explains the ease with which a small fire may be smothered under a quilt; it dies when it can no longer feed upon oxygen.

Wood gives the liveliest sort of blaze. This is due to the fact that when wood is heated it gives off quantities of inflammable gas; the resulting flame is simply burning, or uniting, gas. Flames give light for several reasons. Some gases are highly luminous in themselves, but in the case of such flames as those formed by gas jets, the light is given out by particles of unburnt carbon which are raised to incan-

[redacted] of fire to civilization can hardly be [redacted] It cooks the world's foods, warms [redacted]er and furnishes the energy that drives all the great machines and makes vast industries possible. In fact, fire is so nearly indispensable to life itself that no tribes of men are known who have not the art of making fire, and according to the modern theory it was the discovery of fire and its uses that marked the emergence of man from the lowest condition of savagery (see CIVILIZATION). Primitive peoples have, however, very slow and unsatisfactory ways of kindling flames. One of the earliest ways was that shown in the accompanying illustration, in which a sharp stick rotated between the hands produced heat and then fire.

When fire was so difficult to kindle, it is no wonder that primitive man took care to keep some fire burning all the time. The reason for this practice was later forgotten; nevertheless, fire was still regarded as precious and often as a symbol of sacred things, which explains the reason that fires were kept burning in the temples. Early thinkers of the pagan world developed the mistaken idea that fire is one of the four elements of the world, the other three being air, earth and water. Science has shown that this is not true.

Fire Prevention. The enormous loss in property and lives caused by fires each year can be graphically brought home to everyone by the following illustration: Imagine a street a thousand miles in length, stretching from New York



ANCIENT FIRE MAKERS

(1) A sharp stick rotated swiftly between the hands, friction producing heat, then fire, the most primitive method; led to (2) in which the genius of mechanics is shown. The cord encircles the upright stick and one single length of the cord turning around the stick causes many vibrations of the latter. (3) A great step toward matches; man discovered that striking a stone on a flint produced a spark which ignited dry grass.

to Chicago and lined with buildings of a typical city—homes, churches, schools, factories, stores, etc. Suppose this street, crowded with people and vehicles of every description, should be set on fire at either end, and should burn at

the rate of three miles a day. At the end of a year every building from one end of the highway to the other would be destroyed, and the spectator walking down the scene of desolation would come upon an injured person every thousand feet and a human corpse every half mile.

The ruin pictured in this supposed case is reproduced every year in the United States, where, in 1915, the damage from fire amounted to $184,989,100. The loss in that year was the smallest since 1905. In 1914 the damage amounted to $235,590,000. Besides the loss in property, about 5,000 persons are killed and about 50,000 persons are injured by fire each year. It has been shown that nearly seventy-five per cent of these fires are due to preventable causes. Statistics show that the fire losses in the United States and Canada from 1877 to the end of 1915 amounted to the tremendous sum of $6,049,817,000, or an average loss of $155,122,000 a year. It is in order to prevent this enormous waste that a campaign for fire prevention has been started in recent years, an important element in which is the education of the people to the losses caused by fires and to the means of preventing them.

Causes and Means of Prevention. The loss caused by fire averages about $2.50 a year per head of population in the United States and Canada, while in Europe as a whole it averages only $0.33. The great fire waste in the United States and Canada as compared with European countries is due to a number of causes. In Europe buildings are usually of brick or stone, while in the United States and Canada, where the growth of the cities has been so rapid, the chief material has been wood. The building regulations, too, are more stringent and more rigorously enforced in Europe than on the other side of the Atlantic. In Europe, either in the country or the city, a heap of paper or rubbish is seldom seen, even in the poorest neighborhoods, for the person responsible for its existence is liable to a severe fine. Again, almost every clump of trees worthy the name of forest is either privately owned or is under state protection. Lumbermen and campers are required to exercise the greatest caution in building fires and removing debris.

Another and perhaps more important factor has been that intangible element, the national temperament of the American people. Americans are inclined to be careless and wasteful. The average American has a feeling that anything destroyed can be easily replaced. The average European, on the contrary, who has long felt the pressure of economic forces, and has been made to realize not merely by law but by bitter experience that waste is harmful, has a far better understanding of his duty to prevent needless losses. As a result of a far-reaching campaign of education the American people are beginning to exercise better care, both in factories and in homes, and to show a greater readiness to comply with the precautionary measures against the outbreak of fires. Other measures have been the adoption by many states, provinces and cities of laws and regulations for better and safer buildings, as well as better inspection and increased supervision of buildings by members of the fire department.

Comparison of Fire Losses. The annual losses by fire per head of population average about $2.40 in the United States; $2.75 in Canada; $0.50 in England; $0.65 in France; $0.20 in Germany; $0.15 in Switzerland; and $0.10 in The Netherlands. The losses by fire per head of population in a number of American cities in 1915 were: New York, $1.44; Chicago, $2.46; Philadelphia, $1.68; Boston, $4.06; Pittsburgh, $3.10; Washington, $2.21; and Cincinnati, $1.74. In Canada these losses were: Halifax, $6.73; Vancouver, $5.47; London, $3.62; Hamilton, $3.08; and Winnipeg, $2.34. In some European cities they were: London, $0.60; Birmingham, $1.25; Birkenhead, $1.13; Cardiff, $0.55; Leeds, $0.84; Sheffield, $0.23; Belfast, $0.46; Dublin, $0.22; Paris, $0.61; Bordeaux, $0.61; Marseilles, $0.79; Frankfurt, $0.16; Milan, $0.48; Florence, $0.17; Basle, $0.19; The Hague, $0.07. See FIRE DEPARTMENT. T.R.W.

FIRE'ARMS, a term generally applied to all weapons which are discharged by gunpowder or other explosive. Although they are supposed to have originated in the East and to have been used by the Chinese 2,000 years before the birth of Christ, firearms as we know them date from soon after the invention of gunpowder, in the thirteenth century. The first firearm was undoubtedly a cannon, and it was probably some time before it was discovered that such a terrible explosive could be used in small weapons held in the hand. The effect of even the first crude cannon used in warfare was so terrible that a complete change of military tactics was necessary. Armor was of no further use; knight and man-at-arms were made equal on the battlefield; the castles that had easily withstood the attacks of men

armed with battle axes, spears and bows and arrows crumbled before the assault of the new weapons. Cumbersome pistols, blunderbusses and clumsy muskets were introduced, and the bow and arrow was driven from the field, to be retained only by savages. The rifle was invented in 1498 and since that date multiplied improvements have been made, resulting in the high-powered firearms and explosives of modern warfare.

Related Subjects. The reader is referred to the following articles in these volumes:

Armor	Musket
Arms	Revolver
Artillery	Rifle
Cannon	Shotgun
Machine Gun	Small Arms

FIRE'BALL, a projectile discharged from a gun with the purpose of setting fire to the enemy's works, or by bursting in the air, to illuminate positions beneath and act as a guide to gunfire. During the War of the Nations fireballs were extensively used for the first time in centuries, for since medieval times no nation at war had employed them. The modern fireballs consist of bags filled with a mixture of powder similar to that employed in the making of fireworks. When discharged into the air they become ignited by means of fuses and burn slowly with a bright light, like that given out by the balls in a Roman candle. The name fireball is also given to a meteor which appears like a globe of light passing with great velocity across the sky.

FIRE'CRACKERS, a term applied to several kinds of fireworks resembling small bombs. They are made of cylinders of paper of many layers, in which an explosive charge of gunpowder is placed. A fuse, made of cotton soaked in a mixture of starch and gunpowder, projects from one end. Firecrackers may be made to explode once, or may consist of a long cylinder, tightly tied at intervals, with many charges giving a series of a dozen or more explosions. They vary in size from one-fourth of an inch in diameter and one inch in length, to three inches or more in thickness and more than one foot in length. The explosive is a mixture of powdered charcoal and chlorate and bichromate of potash.

The origin of firecrackers is unknown, but they were probably used by Eastern peoples several thousands of years ago. Their manu- in America in the middle of ury. They were for years us quantities, but the output is decreasing, owing to legislation limiting their use. There is widespread agitation for their entire suppression, as they are dangerous to handle, and their careless use often leads to serious injury. The Fourth of July is the most popular occasion for their use in the United States; in many parts of the world they are a feature attending Christmas celebrations. The Guy Fawkes celebrations of November 5 were formerly the chief occasions for the use of firecrackers in England and Canada. See FIREWORKS.

FIRE DAMP, a miners' name for carbureted hydrogen, or coal gas, found deep in mines and caused by the decomposition of coal. When mixed with air it becomes highly explosive, and has often caused great loss of life by igniting when accidentally brought in contact with the flame of a lamp or candle. A dangerous gas, called by miners "after damp," is produced by the combustion of the fire damp. Accidents due to fire damp were so frequent in English coal mines that Sir Humphry Davy devoted particular study to the subject, and finally invented a lamp which could be used with safety in an atmosphere saturated with fire damp. The safety lamp is now a part of the equipment of every miner, and is worn on the front of the cap. See DAVY, SIR HUMPHRY; MINING.

FIRE DEPARTMENT, a semi-military organization formed to fight conflagrations. Cities in the United States and Canada find it far more necessary to maintain fire-fighting forces than in Europe, where more attention is given to fire prevention. Until recently American fire departments concerned themselves only with extinguishing fires already burning, but now they coöperate with insurance companies in securing and enforcing stricter building laws and in spreading knowledge of the causes of fire. Wooden structures prevail in the United States and Canada, except within certain districts called "fire-limits," but in Europe they are not permitted in any locality where they may endanger other buildings.

In America the highly-trained and efficiently-equipped fire departments of to-day are the outgrowth of the "bucket brigades" which in earlier times passed pails of water from hand to hand, and the volunteer hose companies which ran to a fire pulling their hose carts and hand pumps.

The fire departments of all large cities are organized along very similar lines. Each consists of a chief fire marshal, assistant fire mar-

shals, battalion chiefs, captains and lieutenants, firemen (who are the "privates" of the fire-fighting force), engineers, and veterinary surgeons. Since the introduction of motor-driven apparatus, the latter are reduced in number and more of the men must be technically trained. The various companies, under command of captains and lieutenants, are stationed in widely-scattered permanent quarters, and over groups of these are the battalion chiefs and assistant marshals. From one central point the chief marshal directs all operations. In proportion to population the American and Canadian fire-fighting forces are four times as many as those of Germany and France and three times as many as those of England, yet losses in European countries, which are much more densely populated, are very slight compared to the fire waste in North America.

Fire Engines. The first successful steam fire engine was used in Cincinnati in 1850. But special fire pumps had been known since Roman times; one was described by Hero of Alexandria about 150 B. C. The business of the fire engine is to force water through the hose at a high pressure. The highest type of engine can pump 1,300 gallons a minute. Horse-drawn steam engines are being supplanted by those which are motor driven, and in some cases the pumps are operated by the gasoline motor which propels the vehicle, instead of by steam. Where cities install high pressure water mains, the fire engine becomes unnecessary. Though some pumps can throw water to the height of a twenty-story building, they are little used, as most "skyscraper" fires are fought

MOTOR FIRE ENGINE

from the inside with the apparatus which is a part of the building.

Chemical Engines and Fire Extinguishers. A fire which has not spread far is readily extinguished by carbonic acid gas or other gases. The gas is usually conveyed to the fire in water through a hose, but as much less water and a lighter hose is required than for extinguishing with water alone, the chemical engines can be built lighter, and they are more speedy than the steam engines. They reach the scene of a fire first, and often have it under

COMBINATION MOTOR VEHICLE
Comprising hose cart, hook and ladder equipment and chemical engine.

control before the rest of the department arrives. Hand fire extinguishers working on the same principle have been known since 1816; they are an English invention.

For warehouses, factories, "skyscrapers" and other large buildings, automatic sprinklers are advocated by insurance companies. These consist of pipes, within the ceilings of rooms, containing water under pressure. At intervals, sprinkler heads are attached, the openings being closed by a thin piece of metal which melts at a low temperature. Even a small fire raises the temperature, the metal softens and gives way, and the water is sprayed over the floor.

Fire Escapes. Special measures are necessary to furnish means of escape from public and semi-public buildings in case of fire. There are various crude forms of fire escapes, such as ropes, slings and baskets, by which those in a building may lower themselves to the ground. The most common fire escape, however, is an iron ladder running from top to bottom of a building, with a platform or balcony at each story which may be reached from a window. Enclosed fireproof towers with broad stairways are the best type of escape. Fire departments are equipped with ladders, which may be adjusted to various lengths, and with short *scaling* ladders. Tubes of strong sailcloth through which persons may easily slide are often provided. If all means of escape are cut off it is sometimes necessary for persons in a burning building to jump into large sheets of canvas or tarpaulin held by firemen below. The laws in most civilized countries are strict in requiring factories and public buildings to be provided with adequate fire escapes. When inspection is lax and laws

early Aryan peoples in connection with the cult of the family (see ARYAN). As specifically applied to the ancient religion taught by Zoroaster and still practiced by his followers in India and Persia, the term is rather misleading. In the Zoroastrian cult, fire is employed simply as a symbol of the divine being. After death the soul was supposed to hover about its earthly abode for a period of three days. On the fourth day, *Sraosha,* the good spirit, bore it aloft, closely beset by demons, who sought to relieve him of his precious burden. Fires were then lighted by the friends of the deceased in order to embarrass the evil spirit. See ZOROASTER.

FIRST AID TO THE INJURED. See subhead, in article WOUNDS. For related topics, see ANTIDOTE.

FISH, a water-inhabiting (aquatic) animal, the lowest in the order of vertebrates, or backboned animals. It is distinguished from the higher forms of animal life in that it breathes through gills and its limbs take the form of fins. Although there are a vast number of species of fish, now estimated at about 13,000, there is more similarity among the different species than there is among the various kinds of most other animals. The majority of fish have elongated bodies, tapering at both ends to present slight resistance to the water. The general form has become modified to meet the requirements of surroundings, but not sufficiently so to alter the general type, of which the trout and salmon are good examples.

Fish have cold, red blood and are usually covered with scales growing in the skin and overlapping like the plates in suits of armor or shingles on a roof. The heart of a fish performs the same functions as does the human heart. By it the blood is pumped through the system, first being purified by passage through the gills. The backbone is loosely jointed, enabling a fish to turn and twist in a manner impossible to animals of a higher order. Most fish possess an air bladder found in no other animals, but its purpose is not clear. By some authorities it is regarded as a balance, weighting or lightening the body as required. The fins, usually in pairs, are typical of the fore and hind limbs of quadrupeds, but have not yet reached an equal stage of development.

Reproduction. Many fish are absolutely without anxiety concerning their eggs or young. [illegible] posited in chosen localities, on the bottom of streams and [illegible] or be destroyed, as chance may determine. The loss of eggs and young is very great, for almost every species is the prey of larger fish; so in order to preserve the existence of species a vast number of eggs is deposited. A cod produces about 10,000,000 eggs annually, but beyond depositing them, does nothing to insure their preservation. Other fish, however, are examples of parental care and forethought. The humble stickleback builds a nest of sticks carefully plastered together with gummy excretion, and when the eggs have been deposited stands guard until the young are hatched. Bass and sunfish also guard their eggs. The salmon and the shad ascend rivers to deposit their eggs; the eel reverses this process by returning to the sea to spawn. The eggs of sea fish are hatched more quickly than those of fresh water species. In the sea the loss among the young is greater than in rivers and bodies of fresh water, as there are more species to prey on each other. Some sea fish hatch from the eggs forty-eight hours after deposit; the eggs of the brook trout require three months for hatching.

Food of Fish. Some fish are omnivorous, that is, they eat both vegetable and animal matter; others eat only vegetables, and others again confine their diet to smaller fish, of their own or other species. The appetite of most fish appears to be equal to that of the robin. In carnivorous, or flesh-eating fish, the mouth is very large and the stomach so elastic that even small fishes are able to swallow others nearly as large as themselves. Some species of fish live entirely on minute particles of matter strained from the water.

Some Interesting and Remarkable Fish. Reference has been made above to the stickle-

back, which builds a carefully plastered nest of sticks. Many other fishes build nests, including the lumpsuckers, a deep-sea fish, the chubs, and the sunfishes. The chub usually heaps up a pile of pebbles, on which the eggs are laid; then more stones are piled on top. The sunfish's nest is scarcely worthy of the name, for it is nothing more than a shallow cup scooped out in the sand; yet the sunfish will fight valiantly to defend it. Then there is the *Antennarius,* or frog fish; the male is said to pick up the eggs and blow them from his mouth, along with many bubbles of mucus. These bubbles harden and form a light, floating nest.

The variety of fishes is almost beyond comprehension. Among the 13,000 different kinds, there are tiny fishes and giants, fat ones and thin ones, round ones and triangular ones—all possible shapes, sizes and colors. From the minnow to the shark there are thousands of varieties. The man-eating sharks average thirty to thirty-five feet in length, but in the tropics there is one species which grows to a length of sixty or seventy feet. Then there is the great oarfish, twenty to twenty-two feet long and weighing over 500 pounds; though large, it is the opposite of the shark, for it is stupid and defenseless, and has a body which resembles a tough jelly in consistency and is almost transparent. Some fishes, like the great weever, are protected by poisonous spines, while others, the electric fishes, shock any living thing with which they come into contact. The electric eel of South America, for example, is powerful enough to stun a man. The swordfish and the sawfish have remarkable jaws, which they use not merely for defense but for catching food.

As a rule the fishes of the tropics are more brilliantly colored and show more variations than the fishes of temperate zones. For example, there are the parrot fishes of the Mediterranean Sea and the Indian Ocean; among them bright greens and reds are the predominating colors. One of the most beautiful of those is the flame-colored *scorpaena miles,* a Ceylon fish which has no English name; the Singhalese call it *ratoo gini maha,* which means *great red fire.*

Even in temperate zones there are remarkable fishes. There are the blind fishes of Mammoth Cave, Kentucky; once they had eyes, but from ages of disuse the organ of sight has decayed. There are the many varieties of flying-fishes. One of the most remarkable of all fishes is the salmon, which lives both in fresh water and in salt water. It travels anywhere from twenty to a hundred miles or more in the course of a season, and when spawning season comes ascends some river to lay eggs. It is on the rivers that the salmon perform some of their astounding feats, leaping upward ten or twelve feet, and in this way ascending a river even above falls and other obstacles. There is also the climbing-perch, which occasionally travels short distances overland, is known to climb low bushes and has even been said to climb trees.

Even the common fishes, many of which every child knows, have peculiarities which are as interesting as those of distant places. Some of them like cold water; some, like the sunfishes, prefer the water to be warm. Some, like the familiar chubs, have been known to bury themselves in mud at the beginning of winter and hibernate; others, like the pickerel, are hungry and active in winter, and can be caught with a hook and line dropped through a hole in the ice. There is scarcely a single species of fish which will not repay intelligent study.

Fish as Food. From the earliest days of history fish has formed an important part of human diet, and at the present day is eaten in every country in the world. Fresh water and salt water fish are equally wholesome, and any preference for one over the other is the result of individual taste. Fresh fish is usually eaten boiled, fried or baked. A large quantity of the annual catch of fish is preserved by being salted, dried and smoked, or canned. These processes considerably change the taste but add to the food value of the fish and deduct a large portion of waste and water.

The widespread idea that fish is more easily digested than any other meat is not correct. The digestibility of fresh fish such as cod, mackerel, bass, turbot and others of the common food fishes, is equal to that of good lean beef. Salted fish is not so easily digested, but the percentage of protein absorbed from a pound of salt fish is greater than the percentage from the same quantity of beef (see PROTEINS). Much has been written about the danger of poisoning attending the use of canned fish. Modern methods of canning and scrupulous cleanliness in all the processes of preservation have so reduced the danger of ptomaine poisoning that practically it does not exist. Care should be taken, however, to remove the contents of the can immediately

ermen row a distance away and set the second trawl. In fair weather a trawl may remain set over night; in rough weather it is pulled into the dory and taken aboard the schooner. Pulling the trawl with its catch of fish from off the ocean bottom into the dory is called "under-running" the trawl.

Methods of Catching Mackerel. The methods employed in mackerel fishing differ entirely from those in cod and halibut fishery, as the habits of the fish differ. Mackerel roam over large areas of the sea in a season, while the ground-fish remain near their respective feeding-grounds. Mackerel are caught at the surface of the water; the ground-fish are caught near the bottom of the sea. Mackerel fishing is pursued from April until November, while the ground-fishing is carried on at all seasons of the year. Mackerel are taken along the Atlantic coast from the Virginia capes to Anticosti Island, in the Gulf of the Saint Lawrence. The ground-fish are taken principally on the fishing grounds of New England waters and of the maritime provinces of Canada. Like birds of passage, mackerel migrate from the southern to the northern waters every year. They are first discovered by fishermen off the capes of Virginia in early April. Every spring they spawn in the shallow waters of the New England shores and the Gulf of Saint Lawrence; in the late fall months they gather in large schools and journey southward again. It is a mystery where they live during the winter months.

Formerly mackerel were taken by means of a mackerel-jig, or hook, the fishing being done by single lines from the schooner's deck. Every mackerel schooner now has one or two seine-boats which are used when the setting of the seine is made. Mackerel seines are large nets about 125 feet deep and one-quarter of a mile in length. The seining fleets reach the southern fishing-grounds near the first of April. They follow the mackerel northward as they advance toward New England.

By the middle of May the fleet returns from the southern fishing and sails for the coast of Nova Scotia, on what is called the Cape Shore trip. The mackerel in that region follow along the coast of Nova Scotia on their way to the Gulf of Saint Lawrence. The Cape Shore trip usually is over by the middle of June. During the remainder of the summer the fishing may be in the vicinity of Block Island, in the Gulf of Maine or in the Gulf of Saint Lawrence.

Seining schooners carry crews of eighteen men each. One-half the gross stock of the vessel, after deducting the value of salt, barrels and gasoline used in making the stock, is divided equally among the vessel's crew; the other half goes to the owners of the schooner. The average share per man for a crew of eighteen varies from $22 to $28 for every $1,000 worth of stock, depending upon the expenses and the length of the trip. R.MC F.

Consult Murray's *The Depths of the Ocean;* Jordan's *Fishes.*

Related Subjects. The first section of the above article contains such general descriptive matter as applies to all fish. In these volumes, however, are included scores of articles on the different kinds of fish, and the list which follows will make reference to them an easy task. A few articles of a more general nature are also included in this index.

Alewife
Angler
Aquarium
Archer-fish
Bass
Bluefish
Candlefish
Carp
Catfish
Cod
Devil Fish
Dogfish
Eel
Electrical Fishes
Flatfish
Flounder
Flying Fish
Gar
Goldfish
Grayling
Grunt
Gurnard
Haddock
Hake
Halibut
Herring
Hippocampus
Jewfish
Lamprey
Lantern Fish
Lumpfish
Mackerel
Menhaden
Mullet
Muskellunge
Paddlefish
Perch
Pickerel
Pike
Pike Perch
Pilchard
Pilot Fish
Pipefish
Pompano
Ray
Redfish
Ribbon Fish
Salmon
Salmon Trout
Sardine
Sawfish
Sculpin
Shad
Shark
Skate
Smelt
Sole
Spawn
Sprat
Stickleback
Sting Ray
Sturgeon
Sucker
Sunfish
Swordfish
Tarpon
Tilefish
Torpedo
Trout
Tunny
Turbot
Whitefish
Wolf Fish

FISH, the family name of two American public men, father and son, one notable in political history, the other in business.

Hamilton Fish (1808-1893) won distinction as a lawyer, statesman and diplomat. He was born in New York City, was graduated at Columbia College (now Columbia University)

in 1827, and in 1830, after a course in law, was admitted to the bar. The first of several political honors came to him in 1842, when he was elected to Congress as a Whig. Six years later he won the governorship of New York, and in 1851 was sent to the United States Senate.

Fish became an active member of the Republican party on its organization, and from 1869 to 1877 made a good record as Secretary of State in the Cabinet of President Grant. He was one of the commissioners who negotiated and signed the Treaty of Washington with Great Britain, in 1871 (see WASHINGTON, TREATY OF), and he represented the interests of the United States in the settlement of the claims arising from the depredations of the Confederate cruiser *Alabama* (see ALABAMA, THE). Other diplomatic services included the settlement of the Oregon boundary dispute with Great Britain, and a satisfactory adjustment of the difficulty with Spain growing out of the Virginius affair (see VIRGINIUS MASSACRE, THE). He also brought about important reforms in the consular service, introducing the requirement of civil service examinations of candidates.

Stuyvesant Fish (1851-), son of Hamilton Fish, is an American capitalist and railroad official. He was born in New York, and, like his father, was educated at Columbia College. At the age of twenty, soon after his graduation, he entered the offices of the Illinois Central Railroad Company as a clerk, and rose to the presidency of the road in 1887, which post he resigned in 1906. Fish was chosen a member of the monetary commission created by the conference which met in Indianapolis in 1897, and from 1904 to 1906 was president of the American Railway Association.

FISHER, HARRISON (1875-), an American illustrator who has drawn over a thousand studies of American girl types. Simplicity is the keynote of his art. Although he easily pleases his patrons, he is a severe self-critic, often destroying the work of days because the result proves unsatisfactory to himself. He possesses a fine sense of humor and a love for the beautiful in life, which he brings out in his art. Fisher was born in Brooklyn, N. Y. His illustrations appear in the leading magazines and popular works of fiction, and he is the author of *The Harrison Fisher Book,* which presents in picture the American girl who wins by force of charm and personality.

HARRISON FISHER

FISHER, SYDNEY ARTHUR (1850-), a Canadian statesman and agriculturist, from 1896 until 1911 Dominion Minister of Agriculture, a position in which he exerted great influence for the improvement of agricultural conditions in Canada. He was born in Montreal, attended the Montreal high school and McGill University, and in 1871 was graduated at Trinity College, Cambridge University. Returning to Canada, he devoted himself to scientific farming, particularly fruit-growing and the raising of live stock. He was closely identified with the Quebec Fruit Growers' Association and other organizations for improving the farming conditions of Quebec and the Dominion.

Fisher was an unsuccessful candidate for the House of Commons in 1880, but was elected in 1882 and sat until 1891, when he was defeated by a single vote. He was again elected in 1896 and became Minister of Agriculture in the Liberal Ministry formed by Sir Wilfrid Laurier. While Minister of Agriculture he secured the enactment of many laws in the interests of the farmers and the people at large, organized a health-of-animals branch and the permanent census and statistics branch, and established numerous experimental farms. To his efforts were also due the foundation of the National Art Gallery and the erection of a suitable building for the Dominion archives at Ottawa. He sat in the House of Commons from 1896 to 1911; he was defeated in the general elections of 1911 and was also unsuccessful at another election in 1913. G.H.L.

FISH HAWK, a large bird of prey of the eagle family, found near both fresh and salt water in almost every country. This bird, which feeds only on fish, is also called *fishing hawk, fishing eagle, sea gull* and *osprey,* the latter name being derived from a Latin word meaning *bone-breaker.* It is about two feet long, with body dark brown above, touched with black, gray and white. The under parts are white, sometimes banded across the breast with brown. The tail and wings are long. To aid it in securing food, the short, strong bill is sharply hooked, and the soles of its

strongly clawed feet are covered with pointed scales.

In America, the fish hawks range from Hudson Bay and Alaska to South America and the West Indies. They often live in colonies, but always in pairs. High on an exposed cliff, or in a large, dead tree near water, a huge nest, large enough to fill a cart, is built of sticks. There two to four eggs, brownish, yellow or speckled white, are laid, and when hatched the helpless young live in their airy home for several months. The parents circle gracefully high in the air watching the water for signs of food, which they swoop down upon with a wonderful dash. The bald eagle often pursues the fish hawk and frightens it into dropping its catch, so the latter often supplies food for two families.

THE FISH HAWK

She rears her young on yonder tree;
She leaves her faithful mate to mind 'em;
Like us, for fish she sails to sea,
And, plunging, shows us where to find 'em.
—WILSON:
Fisherman's Hymn.

FISHING. See ANGLING.

FISKE, *fisk,* JOHN (1842-1901), an American philosopher and historian and exponent of the doctrine of evolution, was born at Hartford, Conn. He was the son of Edmund Brewster Green, his own name being Edmund Fiske Green, but after his mother's second marriage in 1855 he assumed the name of a great-grandfather, John Fiske. His early boyhood was spent in Middletown, Conn., where he was known as an unusually intelligent youth. He read and enjoyed Shakespeare at the age of eight and later far surpassed other boys in his knowledge of Latin and Greek. After his graduation from Harvard in 1863 he spent two years in the Harvard law school but never entered legal practice, preferring to devote himself to teaching, writing and lecturing.

In 1869 he gave a course of lectures on the *Positive Philosophy* at Harvard, and in 1871 delivered thirty-five lectures on the doctrine of evolution which attracted the attention of both Darwin and Herbert Spencer. In the [redacted] of 1879 he lectured on American history Royal Institute in London, and after his return to America in 1884 was appointed to the chair of American history in Washington University, Saint Louis, Mo., although he continued to make his home in Cambridge, Mass. Among his contributions on evolution are *Destiny of Man, Outlines of Cosmic Philosophy, Myths and Myth Makers, Idea of God As Affected by Modern Knowledge, The Unseen World* and *Excursions of an Evolutionist.* By the clearness of his style he did much to spread a knowledge of Darwin and Spencer in America. It is, however, through his historical writings that his reputation will endure, as these form a continuous account of events from the earliest American discoveries. Although at times he failed in point of accuracy, he contributed much of value to the history of America. His best known historical works include *The American Revolution, The Beginnings of New England,* and a *United States History* for schools.

FISKE, MINNIE MADDERN (1865-), an American actress, born in New Orleans of theatrical parents. Most of her life has been spent upon the stage; in childhood she appeared with such celebrities as Laura Keene, John McCullough and E. L. Davenport. In 1890 she was married to Harrison Grey Fiske and retired temporarily from the stage. In 1893 she appeared in her husband's play, *Hester Crewe,* and later in Ibsen's *Doll's House* and *Tess of the D'Urbervilles,* the latter a play founded on Thomas Hardy's novel of the same name. In *Becky Sharp,* a drama written around Thackeray's *Vanity Fair,* she enacted one of her most successful rôles. The dominant note of her art is a strong intelligence combined with a keen sense of dramatic realism. She is the author of several plays, and collaborated with her husband in *Foutenelle.* In 1901 she opened Manhattan Theater in New York City, an independent playhouse in opposition to the American theatrical syndicate. Later she joined the great number of noted theatrical stars who have taken up moving picture work.

FISK UNIVERSITY, a coeducational school for colored people, founded in 1865 at Nashville, Tenn., under the auspices of the American Missionary Association and the Western Freedman's Aid Association of Cincinnati. Through the efforts of Clinton B. Fisk, after whom it was named, much was done to raise the standard of colored schools. A grammar school and preparatory college, normal, music and theological departments are maintained, as well

as the college. Each boarder is required to give one period a day to some manual work on the property. In 1914 there were forty-three instructors and 513 students, 206 of whom were in the college. The school has an annual income of about $60,000 from endowment and tuition.

FITCH, CLYDE [WILLIAM] (1865-1909), an American playwright and author, born in New York and educated at Amherst College, where he was graduated in 1886. He was a prolific writer and is credited with the authorship of more theatrical productions than were ever written by any other American. His work sometimes showed the effects of haste, but it was brilliant and distinctive. His first play, *Beau Brummel,* was brought out by Richard Mansfield in 1890, and was enthusiastically received. He was the author of a surprisingly large number of plays, including *The Climbers, The Way of the World, The Girl and the Judge, The Moth and the Flame* and *The Girl with the Green Eyes.* He also adapted many plays from the French and German, including *Sapho* and *The Masked Ball.*

FITCH, JOHN (1743-1798), an American inventor whose life was a long struggle to impress people with the idea that steam power could be used to run a boat. He was born in Connecticut, and after working at many trades was appointed deputy surveyor of Kentucky. In making a map of the northwest regions of the United States the belief was forced upon him that the streams might be navigated by steam. He tried to sell his map to obtain money for experiments, but failed, so he appealed to several state legislatures for help. They refused, but he formed a company and built a small, though crude, steamboat. In 1787 his steam packet made a trial trip down the Delaware at the rate of three miles an hour. The boat Fitch invented used paddles like oars, and was impracticable for general commercial purposes. Had he applied the power to a paddle-wheel, he, instead of Fulton, would have been given the honor of inventing the steamboat. Fitch was given exclusive rights to steam navigation in New Jersey, Pennsylvania and Delaware, and in 1790 he built a boat to carry passengers. There was not enough money to finance this venture, so he went to France to introduce his invention. Failing in this, he returned to Kentucky, disappointed and poverty-stricken, and committed suicide two years later. See SHIP; FULTON, ROBERT.

FITCH'BURG, MASS., the county seat of Worcester County, is a manufacturing city. It is in the northern part of the state, fifty miles northwest of Boston and twenty-eight miles north of Worcester, on a branch of the Nashua River. The city is served by the Boston & Maine, and the New York, New Haven & Hartford railroads and electric interurban lines. The population, which in 1910 was 37,826, was estimated to be 41,781 by the Census Bureau in 1916. About 10,000 of this number are French, and there is also a large Finnish population. The area of the city is twenty-eight square miles.

Fitchburg has an attractive location in the river valley and upon gently-sloping wooded hills. It has the Fitchburg state normal school, a Federal building, courthouse, state armory, Y. M. C. A. building, public library, the Burbank Public Hospital, Whalom Sanitorium, and homes for old ladies, working women and children. Coggshall is the largest of eleven parks. In the Upper Common are fountains of granite and bronze, and the city has a soldiers' monument, erected in 1874. The factories of Fitchburg employ 9,000 people. Important industries include extensive manufactures of revolvers and shotguns, paper, saws, machine knives, steam boilers, turned-wood novelties, axle grease, machinery, ginghams, screen plates, steam engines, steam pumps and machinists' tools.

Fitchburg was settled in 1719 and was a part of Lunenburg until 1764, in which year it was incorporated. It became a city in 1872 and includes the villages of West Fitchburg, South Fitchburg and Cleghorn. G.B.

FITZGERALD, EDWARD (1809-1883), an English translator and scholar, was born in Suffolk and educated in Trinity College. He was a recluse of extraordinary modesty, and it was only through the influence of friends such as Tennyson, Lowell, Thackeray and other noted men of letters that any of his work was given to the public. His fame rests almost entirely upon his translation of the *Rubaiyat* of Omar Khayyam. While he took great liberties with the original text of the *Rubaiyat,* aiming less at the exactitude than at the poetry of the author's thought, the result is a piece of exquisite workmanship justifying Edmund Gosse's definition, "coral building in literature." It is considered the standard among many excellent translations of the famous Persian poem, and is beginning to be recognized by the public not as Persian

but as English poetry. Mr. FitzGerald's writings include *Euphranor, Polonius* and *Readings in Crabbe;* among his translations are *Six Dramas of Calderon, Salaman and Absal* and *Agamemnon.* See OMAR KHAYYAM.

FITZPAT'RICK, SIR CHARLES (1853-), a Canadian statesman and jurist, Chief Justice of the Dominion after 1906. The city of Quebec was his birthplace and his home for over half a century. There he attended the seminary and Laval University, from which he was graduated in arts in 1873 and in law three years later. In Quebec City he established his reputation as one of the foremost criminal lawyers in Canada. From 1879 to 1887 he was Crown prosecutor for the city and county of Quebec. He was counsel for the defense in many famous trials, including that of Louis Riel in 1885, and for many years was also professor of criminal law at Laval University.

Sir Charles entered political life in 1890 as a Liberal member of the Quebec legislature, in which he sat until 1896, when he entered the House of Commons. He was Solicitor-General of the Dominion from 1896 to 1902 and Minister of Justice from 1902 to 1906. After his elevation to the Supreme Court in the latter year he acted several times as administrator of the Dominion in the absence of the Governor-General. In 1908 King Edward VII appointed him one of the British members of the Hague Peace Tribunal, and also made him a member of His Majesty's Privy Council. In 1907 he was created a Knight Commander of the Order of Saint Michael and Saint George, and in 1911 was given the Grand Cross of that order. G.H.L.

FIVE CIV'ILIZED TRIBES, the name given to the Indians belonging to the Cherokee, Chickasaw, Choctaw, Creek and Seminole nations in the former Indian Territory, now a part of the state of Oklahoma. They were given this name in government reports because of their readiness to adopt civilized standards.

These tribes were gathered mainly from the Southern states east of the Mississippi River, and were transferred to the reservation in Indian Territory in 1838 and the years following. For many years they were allowed practically to govern themselves, as though they were small republics under United States protection. Each tribe made its own laws, elected its own officials and conducted its own courts and schools. The tribal government was similar to state governments, with a governor, or principal chief, at the head, and a council composed of two houses, known by the peculiarly-Indian names of *house of kings* and *house of warriors.* All land was owned, not by individuals, but by the respective tribes in common.

After the War of Secession this tribal organization did not continue so successfully, and the government came to see the necessity of bringing the Five Civilized Tribes under its direct control. The principal reason for this was that many whites had come into the Territory and were asking for a share in the government, from which, as non-Indians, they were excluded. A contributing cause was that, since United States laws were not in force in the reservations, many criminals were evading justice by escaping to its borders. A further object, of course, was to meet the demand on the part of the country in general that unused lands be opened for settlement.

In 1893 the government took the first step toward the new order by appointing the Dawes Commission to work among the Indians, persuading them to allow their property to be divided among the individual members of the tribe and to accept United States citizenship. This work was carried on with success. In 1897 Federal courts superseded the old Indian courts, and the following year Congress provided, through the Curtis Act, for a commission to take the census of each tribe and to make fair division of its lands. The enrollment was finished in 1907, showing nearly 75,000 heirs to the vast estate of twenty million acres. It required several more years, however, to make the allotments of land. The division has left many of the Indians extremely wealthy, for their holdings include not only very fertile farming land, but valuable oil and coal fields. This wealth has been the cause of much intermarriage between whites and Indians, so at the present time only about a third of the members of the Five Civilized Tribes are full-bloods. The 1910 census gave the total membership of the tribes as 58,405.

In order to protect the Indians and their property from unscrupulous people, Congress arranged for all lands to be leased or sold under the supervision of a local bureau of administration called the Union Agency. This in turn is under the control of the Department of the Interior. Officials chosen by the Indians themselves have a certain voice in property transactions. The Five Tribes have special schools, but wherever possible the children at-

tend the regular public schools of Oklahoma; and as a good deal of the Indian land is not taxed, Congress appropriates a large sum each year for school purposes.

In time, as their education progresses still further and they show themselves able to assume full responsibility, the government will withdraw its protection entirely, and the Five Civilized Tribes will then become like any other unit of the great body of American citizens. See INDIANS, AMERICAN; OKLAHOMA; also the individual tribes referred to. E.S.C.

FIVE FORKS, BATTLE OF, an important battle of the War of Secession by which the net was drawn round the Confederate army and the close of the war hastened. This battle was fought in Dinwiddie County, Virginia, April 1, 1865. Lee had sent forces under Early to the Shenandoah Valley, hoping to draw Grant away; but Grant, in the meantime, sent Sheridan to oppose Early, who had been defeated in several preceding battles in the Shenandoah. Sheridan then destroyed the crops and the railroads of the entire valley, and it was later said that "if a crow wished to fly the valley's length he must carry his provisions with him." Lee's army was destitute, and he tried to join Johnston, whose forces had been scattered by Sherman, but the Union lines were too strong and Grant cut off his retreat. On the first of April Sheridan routed Lee's army at Five Forks and took 5,000 prisoners. Lee then withdrew his soldiers from Richmond and Petersburg, and a week later met Grant at Appomattox to arrange terms of surrender.

FIVE NATIONS, a confederacy of Iroquoian tribes which formed one of the most remarkable primitive governments ever known. It was organized in what is now the western part of New York state about the year 1570 by a chief of the Mohawk called Hiawatha, and included the chief's tribe and the Cayuga, Oneida, Onondaga and Seneca. In 1722 the Tuscarora were added, and thenceforth the confederacy was known as the Six Nations.

The organization was originally a defensive alliance against neighboring tribes. It had no executive, but was governed by a general council of the chiefs and sub-chiefs of each tribe and did not interfere with local government. It appointed two war chiefs. So effective was the coöperation of the five tribes that although outnumbered by neighboring enemies they advanced their borders and made their influence felt as far as the Mississippi River. But for the arrival of white men their sway might have been extended over the whole of the east, and they might have laid the foundation of a true Indian civilization by diminishing warfare.

Cartier, in 1534-1535, was the first white man to be seen by these Indians, and seventy years later Champlain aided the Algonquins against them. As a result, they allied themselves with the English against the French. In the Revolutionary War most of the tribes fought for the English, though the league was officially neutral. Afterward some of them were given homes in Canada. Of those remaining in the United States, the Oneida are in Wisconsin and New York and a few of the Seneca are in Oklahoma; the rest are on reservations in New York. See INDIANS, AMERICAN. E.S.C.

FIVES, so-called in Europe, but known as *handball* in America, is a game played by two or four persons on a level court enclosed by walls on three sides. A light rubber ball, about half the size of a tennis ball, is used. One player strikes the ball with his hand against the front wall of the court. It must then be returned in the same manner by the opponent after it bounces. The ball is kept in motion back and fourth between wall and court until one side fails to return it. Each failure to return the ball gives one point to the opponents. Fifteen points make a game. Fives is popular in England, especially at the two great schools of Eton and Rugby. See HANDBALL.

FIXED STARS, those heavenly bodies distinguished from planets by remaining apparently stationary, that is, maintaining their relative positions with regard to other stars. In truth, they are by no means stationary, but are flying through space with greater velocity than a rifle bullet; the vast distances between the stars and the earth prevent our eyes from distinguishing the movement. The so-called fixed stars include all the heavenly bodies except the planets, their satellites, comets and asteroids. See ASTRONOMY, for rate of speed of stars and distances from the earth.

It is much more difficult to calculate the directions and motions of these "fixed stars" than those of the planets, but astronomers by means of their delicate instruments and their complicated mathematics have made progress. For instance, the trend of those conspicuous stars which constitute the Great Dipper has been ascertained, and star maps have been made to show what that constellation will look like 100,000 years from now.

FJORD. See FIORD.

... of nations, the distin... armies and fleets, departments ... and parties, and the personal ... rulers and officers. The word is ...m the Anglo-Saxon *flcogan,* meaning *fly in the wind,* and it has the same ... English, Swedish, Danish, German ... The typical form of a flag is that ...ng piece of cloth of light material, ...tton or silk, attached to a staff, ...g devices of special meaning. The flag fastened to the staff is known as ...nd the length from the support to ...d is called the *fly.* The flag as it is ...lay is the result of many centuries of ...nt. In the early dawn of civiliza... felt the need of some token that ...nguish family from family and tribe ..., and from these ancient symbols ...tandards which were emblematic of

...liest national symbols were figures ... metal, wood or stone, borne at the ...le or spear. Standards of this char... carried in battle by the Egyptians, ...ersians, Assyrians and Romans. One ...t ancient Roman standards consisted ...f hay fastened to the end of a pole, ...tin student reads more frequently of ... the eagle standard which was car... the legions in time of battle. The ...Constantine had an Imperial standard ...urple silk, richly embroidered with ...s usually hung from a horizontal ...ut at a later period it was sometimes ...o the side of a staff, constituting a ... It is supposed that the waving ...ated with the Saracens. During the Middle Ages this form of standard came into general use. For the flags of different nations, see subtitles below.

There are several interesting customs in connection with the flags of to-day. Flags are borne on the masts of vessels to designate the country to which they belong, and also on war vessels, to show the rank of the officer by whom a ship is commanded. When a naval ship enters the port of a foreign nation it hoists the flag of that country and fires a salute of twenty-one guns. In the army, each regiment carries a flag as its distinguishing mark. Flags are used for signaling at sea, where, by international codes, ships may communicate with each other. Each nation, also, has its private code. See SIGNALING; SIGNAL CORPS.

To strike the flag is to haul it down, indicating surrender; *to dip* it is to lower it slightly and then to run it up again, a form of salute; if the flag floats half way up the pole it is said to be at *half mast,* a token of mourning; a flag *reversed,* that is upside down, indicates distress. A white flag, often called the *flag of truce,* is used as a token of surrender or as a sign that one of the combatants wishes to communicate with the other. A yellow flag waving over a hospital, vessel or fort means that there is contagious disease within and that the place is in a state of quarantine (see QUARANTINE). Red is the color associated with anarchy or mutiny. Historically, the red flag has often been used as the standard of an extreme revolutionary body, as the Commune of Paris of 1870, and it is the banner of anarchistic bodies to-day. Black banners are usually associated with piracy and warfare where no quarter is given or expected.

United States Flag

...ry of the national emblem of the people begins with the stormy days ...volutionary War. During the first ...s of the struggle several different ... carried by the soldiers. At the ...rd, in 1775, a standard was ...ore, in Latin, the motto, "Conquer or die," and at Bunker Hill, the same year, the pine-tree flag of the New England colonies inspired the American troops. On January 2, 1776, Washington raised over the American camp at Cambridge the first ensign of the united colonies, known as the Grand Union Flag of 1776. On its blue field were

combined the crosses of Saint Andrew and Saint George, symbolizing the union of Scotland and England, and it bore thirteen alternate red and white stripes. The king's colors on the blue field showed that the colonies still acknowledged the sovereignty of Great Britain, and the stripes represented the thirteen colonies.

After the adoption of the Declaration of Independence in 1776, it was felt that a national emblem of union and independence should be chosen, and on June 14, 1777, the following resolution was adopted in Congress:

"Resolved, that the flag of the Thirteen United States shall be thirteen stripes, alternate white and red, and that the Union be thirteen white stars on a blue field."

In this resolution were born the national Stars and Stripes. The flag then adopted had a circle of thirteen stars on a blue field. The story has come down that Mrs. Betsy Ross, flagmaker, residing at 239 Arch Street, Philadelphia, made the first flag and suggested that the stars be five-pointed. The Ross home is still standing, preserved as a memorial. A picture of the Ross home appears in the article Ross, Betsy.

John Fiske, the historian, says that the first American flag with stars and stripes that was ever floated to the breeze was one "hastily extemporized out of a white skirt and an old blue jacket, and some strips of red cloth from the petticoat of a soldier's wife." This crude emblem of a new nation was raised above Fort Stanwix in August, 1777.

THE BETSY ROSS FLAG

The gallant Paul Jones was the first of the naval heroes to make the star-spangled banner a symbol of glory. Placed in command of the *Ranger*, on the same day the flag was adopted by Congress, he sailed for Portsmouth, N. H., on the Fourth of July following, to raise the flag on his ship. As the naval committee presented the banner to him he said, "That flag and I are twins, born the same hour. We cannot be parted in life or death. So long as we can float we shall float together." In February, 1778, his flag received from the French fleet the first salute given the Stars and Stripes by a foreign nation, and in the following April, when the *Ranger* met and conquered the British man-of-war *Drake*, the flag floated for the first time in a naval battle.

In 1794 Congress ordered that after May 1, 1795, the flag should bear fifteen stripes, alternate red and white, and that there should be fifteen white stars on the blue field. This was done so that Vermont and Kentucky, which had been recently added to the Union, might be represented in the national banner. In 1818 Congress passed an act providing for the addition of one star to the flag whenever a new state should be admitted to the Union, and decreeing that henceforth the number of horizontal stripes should be but thirteen. It was decided that each star should be added on the Fourth of July following the admission of the state. At that time the character of the flag was fixed once for all, and stars have been added from time to time until the number is now forty-eight. The thirteen red and white stripes—the two outer ones red—symbolize the original states that won American independence.

Besides the national emblem, there are various other standards used in different departments of the national government. The revenue flag, consisting of sixteen perpendicular stripes, the flags of the admirals and other commanding naval officers, and the President's flag, are shown in the accompanying color plate.

What the Flag Stands For. In the years that have passed since the United States adopted the Stars and Stripes as its emblem, the flag has become to the American people a symbol of national growth, power and influence, of union and of liberty. What the flag stands for in the hearts of the people has been admirably expressed by Henry Holcomb Bennett in the following lines:

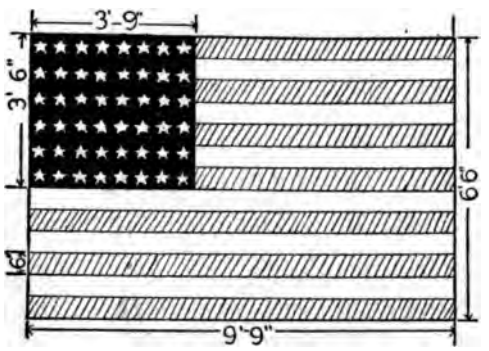
Hats off! Along the street there comes
A blare of bugles, a ruffle of drums,
A flash of color beneath the sky;
Hats off! The flag is passing by!

Blue and crimson and white it shines,
Over the steel-tipped ordered lines.
Hats off! The colors before us fly;
But more than the flag is passing by.

Sign of a nation, great and strong
To ward her people from foreign wrong;
Pride and glory, honor, all
Live in the colors to stand or fall.

Hats off! Along the street there comes
A blare of bugles, a ruffle of drums;
And loyal hearts are beating high:
Hats off! The flag is passing by!

How to Make a Flag. Teachers can provide an interesting and instructive exercise for their classes by having them make an American flag. A banner 9 feet 9 inches long and 6 feet 6 inches wide is one of convenient size, and the proportions, two-thirds as wide as long,



CORRECT PROPORTIONS OF UNITED STATES FLAG

are the same as those prescribed by United States army regulations (see diagram). The field of the union should be 3 feet 9 inches by 3 feet 6 inches, the stripes 6 inches wide. At the back there will be a canvas binding 2¼ inches wide.

The following materials are required: 8 yards of red bunting and 8 yards of white bunting, for the alternate red and white stripes; 3½ yards of blue bunting, for the blue field, or union; 2 yards of stout white muslin for the stars; ½ yard of canvas, 2 harness rings, 2 spools of white thread.

In making the diagram for the union, the length of the blue field should be divided into eighths and the width into sixths, which will give forty-eight oblong sections in which to sew the stars; there will be six rows of eight stars each. To mark the centers, make a pattern of one oblong and punch a small hole in the center. Then lay the pattern on each oblong and chalk the center. Full directions for making a five-pointed star, with illustrative diagrams, may be found in the article STAR. Before stitching a star to the blue field, overcast it with a close stitch and baste it on both sides of the blue. The stitching is done from point to point through the center of the star.

In cutting the cloth for the stripes, allow one-half inch for seams and one inch for a hem at the end of the flag. Plan to have the two outside red stripes selvage. Two harness rings ¾ inch in diameter are placed in the canvas strip 1 inch from the end, and at each back corner, where the rings are placed, the flag should be enforced by an extra piece of bunting, stitched flat, like a patch. Lay the harness rings on the canvas and mark the inside circle. Then cut the goods from the center of the circle to the mark in three or four places, and turn back on the ring, buttonholing over with stout linen thread.

Flag-Day Program. A program along the line of the one following, which has been approved by the educational authorities of New York state, will be found appropriate for the celebration of flag day in the public schools:

1. Chorus—The Star Spangled Banner.....Key
2. Declamation—The Stars and Stripes..Sumner
3. Essay—The Story of the American Flag.
4. Recitation—The American Flag.....Drake
5. Chorus—Battle Hymn of the Republic..Howe
6. Essay—What the Flag Stands For.
7. Declamation—The Man Without a Country .....Hale
8. Chorus—Hail Columbia .....Hopkinson
9. Recitation—The Blue and the Gray....Finch
10. Declamation—Gettysburg Speech ....Lincoln
11. Chorus—Tenting on the Old Camp Ground .....Smith
12. Salute to the Flag by the School.
13. Chorus—America .....Smith

State Flags. In connection with the article UNITED STATES there will be found two pages printed in color, showing forty state flags of the American Union.

Flags of the British Empire

The Union Jack.

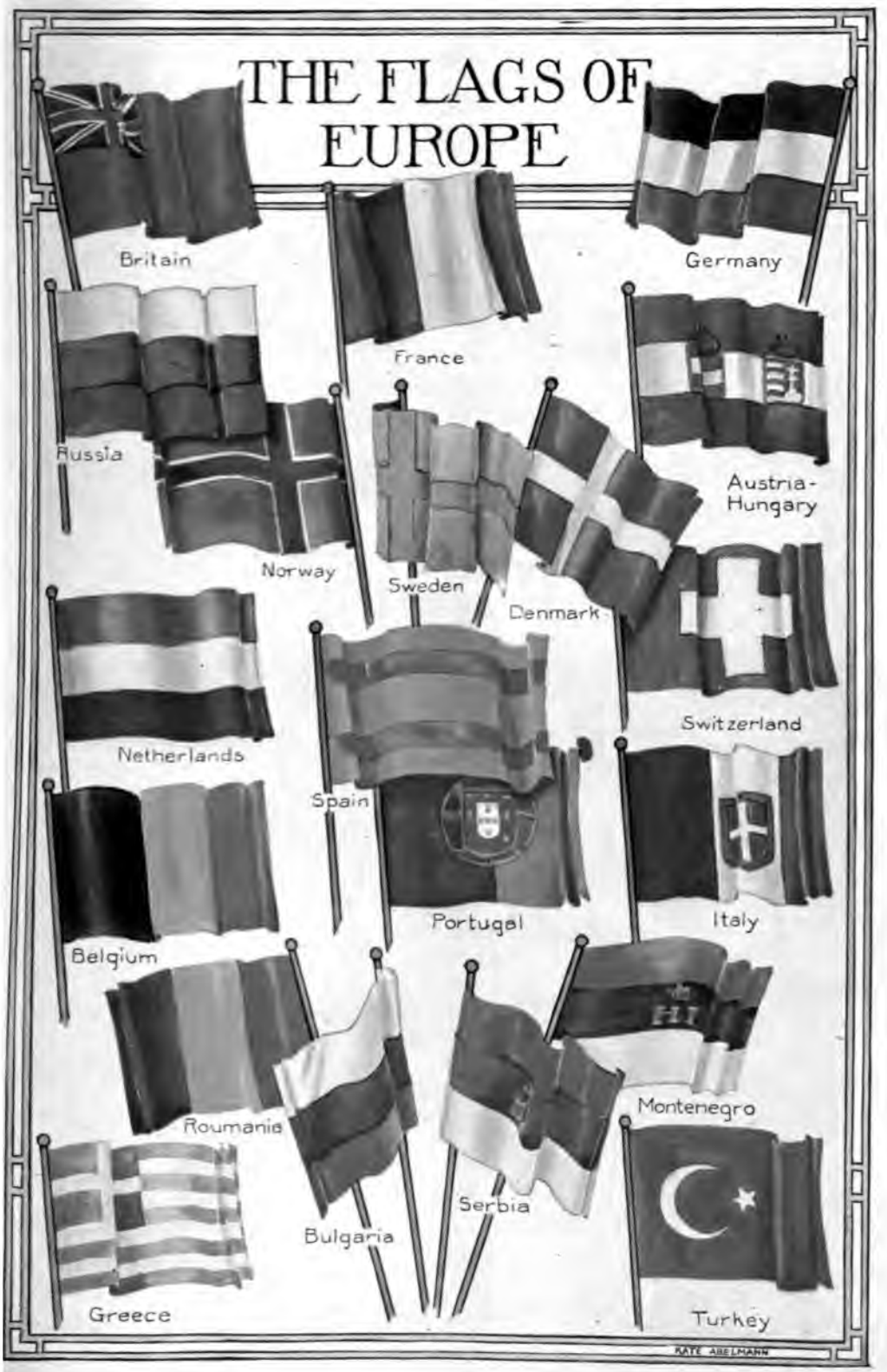
It's only a small bit of bunting,
It's only an old colored rag,
Yet thousands have died for its honour
And shed their best blood for the flag.

It's charged with the cross of Saint Andrew,
Which, of old, Scotland's heroes has led;
It carries the cross of Saint Patrick,
For which Ireland's bravest have bled.

Joined with these is our old English ensign,
Saint George's red cross on white field,
Round which, from King Richard to Wolseley,
Britons conquer or die, but ne'er yield.

It flutters triumphant o'er ocean,
As free as the winds and the waves;
And bondsmen, from shackles unloosened,
'Neath its shadow no longer are slaves.

FLAGS OF THE TWO AMERICAS
United States
Mexico
Canada
Guatemala
Honduras
Nicaragua
Costa Rica
Salvador
Panama
Venezuela
Colombia
Ecuador
Peru
Chile
Argentina
Brazil
Cuba
Haiti
Santo Domingo
Paraguay
Bolivia
Uruguay


THE FLAGS OF EUROPE
Britain
France
Germany
Russia
Norway
Sweden
Denmark
Austria-Hungary
Netherlands
Spain
Portugal
Switzerland
Italy
Belgium
Roumania
Bulgaria
Serbia
Montenegro
Greece
Turkey
KATE ABELMANN

It floats over Cypress and Malta,
O'er Canada, the Indies, Hong Kong;
And Britons, where'er their flag's flying,
Claim the rights which to Britons belong.

We hoist it to show our devotion
To our King, to our country, and laws;
It's the outward and visible emblem
Of advancement and Liberty's cause.

You may say it's an old bit of bunting,
You may call it an old colored rag;
But Freedom has made it majestic,
And time has ennobled the flag.

From the earliest times England, Scotland and Ireland had separate national emblems. England had the cross of Saint George; Scotland, the cross of Saint Andrew; and Ireland, the cross of Saint Patrick. When the crowns of England and Scotland were combined under James I, he commanded that henceforth the man-of-war's flag should be the "red cross commonly called Saint George's cross, and the white cross commonly called Saint Andrew's cross, joined together according to a form made by our heralds, and sent by us to our admiral to be published to our said subjects." This was in 1606 and was the first *Union Jack;* strictly speaking, it should be called the *Great union* or *Union flag,* and it is only a jack when flying from the jackstaff of a man-of-war.

Various changes were made in this flag by Cromwell, Charles II and Queen Anne. While Scotland and England thus had a common flag, each country continued to use its own jack. An English vessel, for example, would fly the Union Jack from the main-top and the English jack from the fore-top; a Scotch vessel would substitute the Scotch jack for the English jack at the fore-top. It was not until 1707, in the reign of Queen Anne, that the "two-cross flag," uniting the red cross of Saint George and the blue cross of Saint Andrew, was adopted as the national flag by Act of Parliament. For nearly a hundred years the "two-cross jack" was the emblem of Britain's power. During this century the British Empire encircled the globe; the two-cross jack was planted in India by Clive, Wolfe's victory on the Plains of Abraham placed it on the citadel of Quebec, and it was the first British flag to fly in Australia and South Africa.

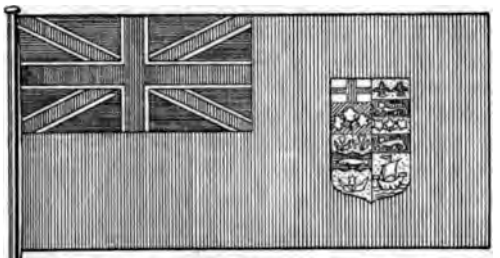
Ireland had long been ruled by the English king, but it was only in 1801 that the cross of Saint Patrick was united with the crosses of Saint Andrew and Saint George to form the Union Jack, which is still the national flag of Great Britain and its colonies. It is the most important of all British flags. It flies from all fortresses, garrison posts and armories in the British Empire, and is the proper flag to fly from public schools and private homes. With the Irish harp on a blue shield in the center it is the flag of the lord-lieutenant of Ireland. The star and arms of the order of India make it the flag of the viceroy. The Governor-General of Canada uses the Union Jack with the Dominion coat of arms in the center, surrounded by a garland of maple leaves surmounted by a crown.

The Three Ensigns. An ensign is a flag with an oblong Union Jack in the upper corner next to the staff and a field of red, white or blue. This corner, from the fact that the symbol of union was placed on it, is now itself called the *union.* The ensigns were originally all naval flags. In the days of great battle-fleets, such as that which met the Spanish Armada, there were usually three admirals, each with his special ensign. The admiral in command of the whole fleet used a plain red flag. The vice-admiral, who generally commanded the van, used a white flag, and the rear-admiral used a blue one. Later the combined crosses of Saint George, Saint Andrew and Saint Patrick were added, and until 1864 the three ensigns were used only by the royal navy. By a change in the regulations in that year, the royal navy retained only the white ensign, while the red ensign was assigned to the mercantile marine and the blue ensign to all government vessels except those of the navy.

The Royal Standard. The royal standard is also a union flag, for it is the symbol of the personal tie which unites all Britons throughout the world under one king. It is divided into four quarters, the first and fourth representing England, the second Scotland, and the third Ireland. The English arms in the first and fourth quarters are three gold lions on a red field; the Scotch arms are a single lion, in a heavy frame, in red on a gold field; the Irish quarter shows a golden, winged harp on a blue field.

The royal standard is the personal flag of the sovereign, and it should be displayed only "when the sovereign is actually present, or when any member of the royal family is present representing the sovereign." It should never be used for street decorations, but it is customary to fly it on the sovereign's birthday and on the days of his accession and coronation.

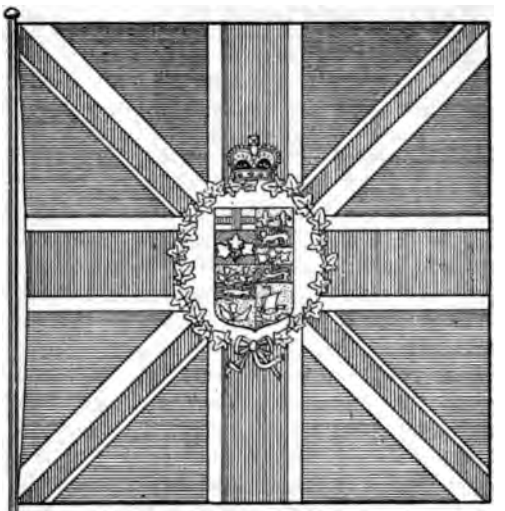
Colonial Flags. The Union Jack is the proper flag to fly on the Parliament and legislative buildings of British dominions. It is also the proper flag for schools. The Dominion of Canada, the Commonwealth of Australia, New Zealand, and the Union of South Africa all have a special national flag, which is the red or blue ensign with the proper



FLAG OF THE DOMINION OF CANADA

colonial arms in the fly. The Canadian flag, therefore, is the red ensign with the Canadian coat-of-arms displayed in the center of the fly. The red ensign is used at the opening and closing of Parliament and on national occasions of any sort. As in Great Britain, the blue ensign is used only on government vessels, except that the Indian Marine flies the blue ensign with the Star of India in the fly. All other ships and vessels belonging to His Majesty's subjects—

"shall wear a red ensign free from any badge or distinctive mark . . . . Colonial merchant vessels shall wear the red ensign as above, except those of Canada, Australia, New Zealand and



FLAG OF THE GOVERNOR-GENERAL OF CANADA

South Africa, which may by Admiralty warrant wear the red ensign with the badge [that is, the coat-of-arms] of the colony in the fly thereof. Any colonial merchant vessel may, however, carry a distinguishing flag with the badge of the colony thereon, in addition to the red ensign."

Flags of European Countries

The national flags of the principal European countries are shown on the accompanying color plate, THE FLAGS OF EUROPE. It is not necessary, therefore, to give more than a few words of explanation to each flag. In every case the flag shown is the national flag, and is that used by the merchant marine. The navies and the rulers of these countries have special flags which need not be described here.

Austria-Hungary. The Austrian flag has three broad horizontal bars, one white between two red; the Hungarian flag has the same design but the colors are red, white and green. For this reason the lower bar of the Austro-Hungarian ensign is half red and half green. The arms on the flag are those of Austria, at the left, and Hungary, at the right.

Belgium. This is one of the many nations [redacted] a tricolored flag, the black, yellow [redacted] the ancient colors of the prin[redacted]bant. With the royal arms in [redacted] golden lion on a black shield— [redacted]s the royal standard.

Denmark. The Danish flag is the oldest now in use. The story goes that in 1219 the great king Waldemar II was treacherously attacked in his camp, and his own life and his army were only saved by a miracle. At a critical moment the king saw descending from Heaven a red banner with a white cross on it. With this flag at their head the Danes fought on to victory, and it has ever since been the emblem of Denmark.

France. The French flag dates from 1789, the year of the French Revolution. The *tricolour*, as it is popularly called, combines blue and red, the colors of the city of Paris, with the white of the royal house of Bourbon. The addition of the white was the suggestion of the Marquis de Lafayette, gratefully remembered for his part in the American Revolution.

Germany. The German flag, three horizontal bars of black, white and red, dates from the formation of the North German Confederation in 1867, and remained unchanged on the foundation of the German Empire in 1871. It

combines black and white, the colors of Prussia, with red and white, the colors of the Hanseatic League.

Greece. The colors of the Greek flag, blue and white, were adopted in 1833 in compliment to Otto of Bavaria, who became the first king of modern Greece. His arms were light blue and white, but after he was deposed in 1862 the Greek flag became dark blue and white, the present colors. The canton or union of the flag bears a Greek cross in white on a blue ground, this being the royal standard.

Italy. The flag of Italy—vertical bars of green, white and red—was designed by Napoleon I, his idea being to give the kingdom of Italy, which he created, a flag of its own, but at the same time to indicate its source by its close resemblance to the flag of France. In 1848 this flag was accepted by King Victor Emmanuel II of Sardinia, who added to it the arms of his family, the House of Savoy. When he became king of United Italy the flag was retained. It is exactly like the flag of Mexico, except for the addition of the arms of Savoy.

The Netherlands. When Holland became independent in 1579 it adopted as its flag the colors of William of Orange—orange, white and blue, and in 1599 it was officially decided that the flag should be composed of three stripes of equal width. Just when or why the orange was changed to red is not known—one historian says the change was probably due to the "indefiniteness of the orange and its liability to fade in the salt sea air." It is certain that by 1643 the Dutch flag had assumed the familiar form shown in the color plate.

Portugal. Although a republic since 1910, Portugal has kept the flag of the monarchy, with the royal arms. The arms were devised by King Alphonso I in 1139, to commemorate the victories over the Moors by which Portugal won independence. On a silver shield are five small blue shields arranged in the form of a cross, and each blue shield bears five silver spots. The five blue shields represent five Moorish princes whom Alphonso defeated, and the five spots are the five wounds of Christ, who gave Alphonso strength to conquer. A red border, with seven golden castles, was added in 1252 after King Alphonso III married a princess of Castile. On the national flag the arms are placed in an armillary circle of gold; this circle, added in honor of Prince Henry the Navigator, represents the relative positions of the principal celestial sphere. The fly of the flag is red, the national color, while the band of green is also in honor of Prince Henry.

Russia. The imperial standard of Russia, the double-headed eagle, dates from 1472, when Ivan the Great married the niece of Constantine Palaeologus and assumed the arms of the Eastern Empire. When Peter the Great began to create a Russian navy and mercantile marine he wanted a flag for his ships. He did the most natural thing under the circumstances; he adopted the colors of the Dutch, who had taught him how to build ships. Peter reversed the order of the bars, making them blue, white and red, but some later expert, realizing that a flag reversed was a sign of distress, again changed the flag to its present form.

The present Russian flag, reversed, was adopted by Serbia as its own emblem to commemorate Russia's aid in winning independence for its fellow-Slavs. Montenegro's flag is the same as Serbia's except for the initials H. I. surmounted by a crown.

Spain. The flag of Spain combines yellow, the color of Aragon, with red, the color of Castile. The flag of the royal navy has a broad yellow band enclosed by a narrower red band at top and bottom; on the yellow band and near the flagstaff are the arms of Leon impaled on those of Castile.

Switzerland. The Swiss flag is red with a white cross in the center, the flag of the mediaeval Crusaders. An early Swiss chronicler, after giving a list of the Swiss forces leaving Berne in 1339 to march against an alliance of the nobles, tells why the flag was chosen: "All were distinguished by the sign of the Holy Cross, a white cross on a red shield, for the reason that the freeing of the nation was for them a cause as sacred as the deliverance of the Holy Places." The Swiss flag, with the colors reversed, is the familiar Red Cross.

Turkey. The origin of the Turkish flag is veiled in legend, but according to the story generally accepted is as follows. Philip of Macedon, father of Alexander the Great, was besieging Byzantium in 339 B. C. He was meeting with no success, but as a last resort attempted at night to undermine the walls. On the appointed night, however, the crescent moon shone so brightly that the defenders saw the attackers in time and saved the city. In gratitude to Diana the crescent was adopted as the city's emblem. When the Turks captured the city in 1453 they promptly appropriated the crescent and henceforth put it on

the plain red flags which they carried. However this may be, the crescent is certainly Byzantine in its origin, whereas the star's meaning is unknown. According to one account it was a part of the arms of Richard I of England and stood for the star of Bethlehem; according to others it is Al Tarek, the star of piercing brightness mentioned in the Koran.

Flags of Central and South America

Unlike the flags of other parts of the world, those of the Central and South American countries are mostly without historical or legendary background. Some of them were frankly copied from the United States or European flags, and others seem to have been chosen because somebody in authority thought they were pretty. Chile, Cuba and Panama show the influence of the United States flag, and Salvador has an obvious copy. Paraguay simply adopted the Dutch colors, to which it added a distinctive badge. Many of the flags, however, including those of Argentina, Bolivia, Guatemala, Honduras and Peru, have no distinction; they seem to be the national colors for no particular reason.

Brazil. This country's flag is an exception to the rule for Central and South America. The lozenge-shaped mass of yellow is unique, and it is one of the few flags to show a motto. On the band encircling the sphere are the words *Ordem e progresso,* meaning *order and progress.*

Costa Rica. The blue, white and red of this little country's flag seem to be taken from the colors of the United States, but the arrangement of the stripes, with a broad band of red in the center, is unusual.

Dominican Republic. This flag, of red, white and blue, is of an unusual design. A white cross of Saint George divides the field into four cantons, the first and fourth being blue, the second and third, red.

Mexico. The Mexican flag has three vertical bars, green, white and red. It is exactly like the Italian flag, except that the latter bears the arms of the House of Savoy in the center of the white stripe. Mexico adopted the Italian flag because it looked pretty, in spite of Italy's protests. When Mexico refused to abandon its new colors, the Italians changed their flag by adding the royal arms.

Uruguay. Uruguay's flag is like that of Greece, except that the order of the bars in the field is reversed, and the canton shows a sun "in splendor," whereas the Greek canton bears a white Greek cross on a blue ground.

Flags of Asia

China. Until 1912 the Chinese flag bore a silver dragon on a yellow or golden field. With the formation of the republic, however, this symbol of the ancient monarchy was abolished and a new flag adopted. It consists of five broad horizontal bands of color, in order from top to bottom, crimson, yellow, blue, white and black. These colors symbolize the five races or five divisions of the republic: crimson is for the Chinese proper; yellow, for the Manchurians; blue, for the Mongolians; white, for the Tibetans; and black, for the Mohammedans (Turkestan). This is the national flag, and is also used by the merchant marine.

Japan. The Japanese flags in their present form date only from 1897, but the designs, with only a little change, have been used for centuries. Appropriately enough this "land of the rising sun" uses a representation of the sun on its flag. The merchant flag shows only a disk on a white field, but on the imperial flag broad bands of red, like rays of light, radiate from the central disk. The imperial standard, a conventionalized golden chrysanthemum on a red field, is almost equally well known.

Siam. The "land of the white elephant" this country is called, and the national flag displays a white elephant in the center of a plain red field. The royal standard is the same except that the elephant wears his harness and trappings and is standing on a platform, and in the upper corner, next to the hoist, is an anchor and wheel. (For the legend of the white elephant, and the veneration in which it is held, see SIAM.)

Persia. The flag of Persia is a "symphony in color," with its equal horizontal bars of green, white and pink. On the standard the green and pink bands are narrowed into borders, and on the wide, white central field is displayed a lion holding a sword. Above its back shows a blazing sun. B.M.W.

Consult Campbell's *Our Flag,* or *The Evolution of the Stars and Stripes;* Gordon's *The Flags of the World.*

FLAGEOLET, *flaj o let'*, a small wind instrument, formerly used in orchestras. Its sound is regulated by six holes, besides one each at the bottom, mouthpiece and behind the neck. Its compass is two octaves. The quality of its tone is shrill, but softer than that of the piccolo.

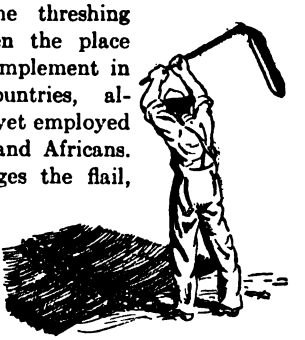
FLAGG, JAMES MONTGOMERY (1877-), one of the most successful of American illustrators and an interesting and witty writer. He works with equal ease in charcoal, crayon, pen-and-ink, water-colors and oils. Although he has won considerable success in portraiture, he is at his best as an illustrator. He possesses a gift of humor which seems inexhaustible. Flagg was born at Pelham Manor, now a part of New York City. At the age of fourteen his first accepted drawing appeared in *Life,* and when fifteen his work was bringing him an income of about $1,200 a year. Since then he has contributed regularly to many of the leading magazines and has illustrated several works of fiction. Notable among his own publications are *Yankee Girls Abroad, All in the Same Boat, If—A Guide to Bad Manners, Why They Married, The Adventures of Kitty Cobb* and *A Book of Tomfoolery.*

JAMES MONTGOMERY FLAGG

FLAG OF TRUCE, a flag, or any white material, hoisted by one of two warring parties to indicate a desire to communicate with the other. By international law and custom a flag of truce is granted certain privileges, but the general impression that all hostilities must necessarily cease as soon as a white flag is hoisted is wrong. Once acknowledged or accepted by the enemy, however, such a flag assumes a sacred character, and the person carrying it and bearing messages must not be harmed. Any attempt to take advantage of the use of a flag of truce for obtaining information is punishable by the sternest measures. Firing on a white flag after there has been an expression of willingness to "parley," or communicate, is regarded as treacherous. The same applies to the act of firing on the enemy while claiming the protection afforded by a flag of truce.

The hoisting of a white flag by a body of troops or garrison hard pressed does not imply instant surrender, but a desire to discuss terms for such surrender.

FLAIL, *flayl,* a hand implement in early days in use on the farm to thresh any kind of grain. The flail consisted of a short, thick club attached by a leather thong to a long wooden handle in such a way that it could swing easily. The threshing machine has taken the place of this primitive implement in all advanced countries, although the flail is yet employed by some Asiatics and Africans. In the Middle Ages the flail, made much stronger and furnished with iron spikes, was used as a weapon of warfare. It was one of the earliest of the world's weapons to be retained in the hand during combat.



THE FLAIL

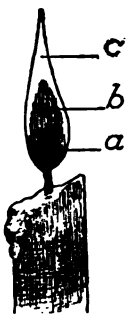
FLAME, the outward and visible sign of burning gas or vapor. When a candle burns it is not the solid wax that ignites, but the melted wax which has been drawn up to the top of the wick and there vaporized. A similar thing happens when we get flame from other solids or liquids.

Flame is always accompanied by heat, and generally by a bright flare of light. It is a mistake, however, to suppose that a substance is not properly a flame unless strongly luminous, for some gases burn with very little light. Hydrogen, for example, which burns at an extremely high temperature, has a very faint blue flame, almost invisible.

What Causes Flame. Flame is the result of the combustion that occurs when the solid particles of the gas—generally atoms of carbon—come into contact with particles of oxygen in the air (see COMBUSTION). Without oxygen there can be no flame. If we exclude air from a fire it will not burn; and if a lighted candle is placed in a bottle filled with "bad air" breathed out of the human lungs its flame will be extinguished almost immediately, because the oxygen in the air was used up before exhalation.

Its Triple Structure. If we take the flame of a candle or a gas-jet as a type and observe it

closely, we notice three distinct parts. First, there is the dark central cone (*a*) around the wick (see illustration), composed of gas or vapor that is not burning and cannot burn because entirely shielded from the air and not yet at a high enough temperature. The technical name for this inner portion is the *area of no combustion.* Surrounding this inner cone is a bright white envelope (*b*) called the *area of partial combustion.* This section of the flame is made up of carbon particles, freed from the gas by the high temperature and raised to white heat so that they give forth a bright radiance. It is this part, generally considered the true flame, that is responsible for almost all the light. The yellowish outer envelope (*c*) is known as the *area of complete combustion,* for here there is a plentiful supply of the oxygen needed for the combustion process. While this is the very hottest part of the flame, it gives almost no light, because as fast as the carbon atoms ascend into it they are consumed and changed into carbon dioxide and invisible water vapor.



FLAME Explanation appears in text-matter.

What Makes a Flame Hot. The heat of a flame depends upon the rapidity and completeness of combustion, and it is oxygen that is essential for combustion. It follows, then, that if an extra supply of air can be mixed with the gas before it reaches the point where it is to be burned, more intense heat will result. That is why a blacksmith uses a bellows on his forge fire; why fireplaces and furnaces have draft-making chimneys; why the gas range and the Bunsen burner of the laboratory—both devices for supplying strong heat—are made with openings to admit air (see BUNSEN BURNER). Looking closely at the kitchen gas-stove, we find that the gas is blown from a little nozzle into a rather large pipe. There are air openings back of the gas nozzle, and what is consumed in the burner is therefore a mixture of gas and air.

Why a Flame Smokes. Smoke results from imperfect combustion; in other words, if there is not enough oxygen to feed it properly the flame will smoke. When the blacksmith is not using his fire it burns low, smoldering and smoking; when he needs it he applies the bellows, the flames leap up, the smoke disappears, and the fire gives forth the strong heat he requires for his purposes. In the modern oil lamp the glass chimney, resting upon a perforated bottom, permits a good circulation of air about the flame. If these perforations are allowed to become clogged with dirt or oil, a smoky flame and a poor light will result.

What Makes a Flame Luminous. The brightness of a flame, as is evident from the explanation of its structure, depends upon the number of solid particles suspended in it, throwing off light as they become highly heated. When gas manufacturers want to give additional brilliance to illuminating gas, they "enrich" it by the artificial introduction of other carbon gases. The luminosity of a flame is also affected by temperature. If the gas and the air are heated before being admitted to the burner, the flame will be correspondingly brighter.

Why Flame Ascends. A flame always ascends, not only because it is the natural tendency of hot gas and air to rise because of its lightness, but also because the flame creates its own draft. Immediately over it is a column of heated air; as this air rises, the cold air rushes in from all around to take its place. This is heated in turn, and there results a continuous flow of air to the flame and around it, creating a little wind or air current that blows the flame upward. If for any reason we want to send the flame in some other direction, we must supply an artificial draft. L.M.B.

FLAMEN, *fla'men,* in the ancient Roman religion the name applied to a sacrificial priest who was consecrated to the service of some special divinity. Originally, there were three: *Flamen Dialis,* priest of Jupiter, *Flamen Martialis,* priest of Mars, and *Flamen Quirinalis,* priest of Romulus. These constituted the *Majores,* and were always chosen from the patrician class; later twelve were appointed from the plebeians, and these were called the *Minores.* The *flamines* held office for life, but were subject to removal for neglect of duty. They were prohibited from leaving the city, from mounting or touching a horse, from touching a dead body and from numerous other acts which were supposed to contaminate them.

FLAMINGO, *fla ming'go,* an odd-looking, beautifully-colored, webb-footed water bird. With its gooselike body, long legs and long, slender neck, it stands from five to six feet high. The bill is big, naked and bent abruptly down, as if broken in the middle. The plumage, for which it has been sought and from which it takes its name, is usually deep ver-

milion, like a flame; however, it may be light red, pink or white, set off by black wing quills. A flock of flamingos in a marsh or on a river bank, or migrating in V-shaped flight, is a delight to the eyes. Several different species are found in Mediterranean and tropical coun-

FLAMINGOS

tries, and they were once common in the Southern United States; but hunters for plumage have so decreased their number that they are rarely seen north of Central America.

In feeding the flamingo buries its bill, top downward, in the water, then sways its head from side to side, causing currents of water to pass through the bill, where fine horny projections strain out the seeds and small water animals that are stirred up from the bottom by the bird's feet. The nest is really a mound of mud built high enough only to keep the eggs out of the water, and on this the mother bird sits with legs folded beneath her. The early Romans regarded flamingo tongues as a desirable delicacy, and these shared with peacocks' tongues the place of honor at the grossly-extravagant feasts of royal and princely houses.

FLAMMARION, *fla mah re ohN',* CAMILLE (1842-), a French astronomer and writer of scientific books. Some of his statements look so far into the future as to seem in part fanciful. He was born at Montigny-le-Roi, and studied at the Paris Observatory and later at the *Bureau des Longitudes.* In 1868 he began a series of balloon ascensions for the purpose of studying the heavens. In 1887 he founded the French Astronomical Society. He is famous for his original researches in astronomy, but is still better known for his excellent and accurate handbooks, many of which have been translated into English, including *The Unknown and Psychic Problems; Marvels of the Heavens; Urania; Lumen* and others.

FLANDERS, *flan'derz,* the old name of a portion of Europe including at one time the provinces of East and West Flanders in Belgium, part of the Dutch province of Zealand and the French department of Le Nord. Philip the Bold, king of France, appointed his son-in-law Baldwin to rule over this territory, with the title of count, early in the ninth century. Baldwin imported into the country great numbers of skilled makers of woolen goods and started the commercial progress of both Flanders and surrounding territories. Though at one time the counts of Flanders were more powerful than the French kings, the French on the south and the Dutch on the north gradually encroached on and lessened these dominions. On the death in 1477 of Charles the Bald, who, by marriage, had united Flanders with his own duchy of Burgundy, the Austrian house of Hapsburg became rulers of Flanders.

In Napoleonic times Flanders was incorporated with the French Empire, and by the Congress of Vienna was united to Belgium and Holland, forming the kingdom of the Netherlands. Between 1830 and 1832 Belgium gained its independence, retaining the present provinces of East and West Flanders. East Flanders has an area of 1,158 square miles, and is one of the most thoroughly cultivated provinces of Europe. The capital is Ghent, a noted manufacturing center. West Flanders, the capital of which is Bruges, has an area

LOCATION MAP
(*a*) West Flanders; (*b*) East Flanders.

of 1,249 square miles. During the War of the Nations both these provinces were overrun and occupied by the German armies. See BELGIUM; WAR OF THE NATIONS.

FLANNEL, *flan'el,* a woolen material, soft and yielding in texture, varying in weight and quality, made from loosely-woven yarn. Its origin is uncertain, but is assigned to Wales, where the fabric was manufactured as early as the sixteenth century. In modern times so many materials come under the term flannel that the word can hardly be considered as having an individual meaning. The flannel trade has suffered severe competition by the great increase in the number of imitations, but there is always a ready demand for the genuine article, as experience has confirmed its hygienic value for undergarments and bed-coverings.

FLATFISH, a name given various fishes, chiefly of salt waters, which have flattened bodies, with both eyes on one side of the head, and which swim on their sides. Some of the most important food fish, such as the flounder, turbot, halibut and sole, are flatfish. When these fish are first hatched, they are like all other fish, with eyes placed on both sides of the head. They soon begin to flatten, however, one eye moves over close to the other, the mouth becomes twisted, and the blind side, which is kept downward, loses its color. See each fish named, in its place in these volumes.

FLAT'HEADS, the popular name for the small civilized tribe of Salish Indians, now living on a reservation in Montana.

Originally the Salish were one of the most powerful of all the Western tribes, possessing great hunting-grounds on Flathead Lake and in Flathead Valley, Montana. They were courageous in war, honorable in all their dealings with white traders, and generally distinguished for their superiority over other tribes. None other of the Indian missions proved so successful as the Flathead mission, established in 1841 by a Jesuit priest, Father de Smet.

The name *Flathead* seems a curious contradiction, for the Salish were one of the few tribes that did not follow the old Indian custom of artificially deforming the head. This primitive practice has now died out, but in the early days it was common among the tribes living along the Columbia River and on the Pacific coast, such as the Choctaw, Catawba, Natchez, Chinook, and others, to whom the term *flathead* was very properly applied. Among the Chinooks, indeed, a naturally-formed skull was considered a mark of dis[illegible]e and fit only for slaves. The flattening [illegible]one in babyhood by making the cradle with a projecting head-board of wicker which, pressing down upon the infant's head, prevented natural growth and resulted in a peaked skull. It is likely that the name *Flatheads* was given to the Salish by their western neighbors in contempt and because they looked upon their own deformed heads as pointed rather than flattened. See INDIANS, AMERICAN.

FLATTERY, *flat'er i,* a cape at the southern entrance to the Strait of Juan de Fuca, in the state of Washington. It is the extreme western point of the United States, exclusive of Alaska. The name was conferred on this point by Captain James Cook, who stated that he was flattered by the false hope of finding a safe harbor there. There is a lighthouse half a mile northwest of the cape, on Tatoosh Island.

FLAVELLE, *fla vel',* JOSEPH WESLEY (1858-), a Canadian merchant and philanthropist, noted no less for his active and generous interest in many good causes than for his success in business. He was born near Peterborough, Ontario, and attended the public schools of that city, but after 1887 made his home in Toronto. His business interests are varied; he is president of a firm of pork-packers, and is an officer in several banks, a trust company and several large industrial firms. He endowed a professorship of Hebrew in Victoria University and a traveling fellowship in the classics in the University of Toronto, and is a governor of the latter. He has also been active in the management of the Toronto General Hospital and the General Board of Missions of the Methodist Church. In 1915 he was appointed chairman of the Imperial Munitions Board, a position corresponding to that of Minister of Munitions in Great Britain, but not a Cabinet office. The concentration in his hands of the executive and administrative duties regarding the supply of munitions was widely approved. In 1915 Flavelle was appointed a member of the national commission to inquire into agriculture, immigration, transportation and marketing of food products, with a view particularly to stimulating production in Canada to meet new conditions caused by the war. G.H.L.

FLAX, *flaks,* one of the most useful plants known to man, cultivated for its long, silky fiber, from which linen thread and cloth are made, and for its seed, which yields a valuable oil. The products of the flax fiber are found in wonderful variety, and include rare and delicate laces, shirtings and toweling, handker-

chiefs and tablecloths, twines, sailcloth, rope and cordage. From the seeds linseed oil is obtained; this is used in mixing paints and varnishes, in making linoleum and oilcloth and for medicinal purposes. Linseed meal, which is manufactured from what is left of the seeds after the oil is pressed out, is an excellent food for farm animals.

FLAX
Stalk and flower.

This valuable plant has been cultivated from the earliest historic period. Mummies over 4,000 years old, wrapped in linen cloth, have been found in Egyptian tombs, and flax is mentioned in the book of *Exodus* as one of the products of the country when it was ruled by the Pharaohs. Egypt still produces large quantities of flax, and the plant has also an extensive growth in India, Argentina, Uruguay, the United States, Canada, Russia, Austria-Hungary, Belgium, France, Holland, Rumania and Italy.

The so-called New Zealand flax, which is of economic importance in New Zealand and has been introduced into California for its fiber and into Europe as a decorative plant, is, strictly-speaking, not flax at all. Its correct name is *phormium*. Its leaves are sword-shaped and grow from the base of the plant, and its flowers blossom on a stalk once or twice the height of a man. The fiber is chiefly valued for rope and twine.

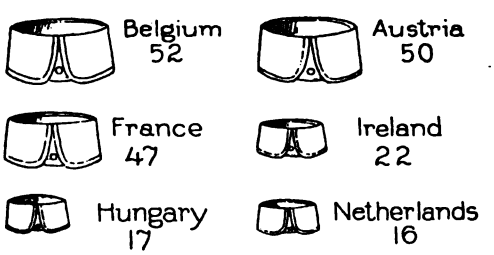
In the United States and Canada flax is raised chiefly for its seed, but farmers are beginning to cultivate it for the fiber. North Dakota leads in the United States in the amount of flaxseed produced, with 660,000 acres in 1915, yielding about 6,534,000 bushels. The annual yield of flaxseed for the United States is about 23,000,000 bushels. In Canada from 1910 to 1915 the yield varied from 4,000,000 to 17,000,000 bushels, Saskatchewan produced nearly six-sevenths of the Dominion's crop from 1911 to 1915.

Description and Cultivation. The country landscape affords no more charming sight than that of a field of flax in full blossom. The slender, erect stem grows to a height of two or three feet, branching near the top and bearing small nodding flowers of a beautiful shade of blue, though in some species the blossoms are white. Longfellow was thinking of the more commonly-known plant when he described the little maiden in his *Wreck of the Hesperus:*

> Blue were her eyes as the fairy flax,
> Her cheeks like the dawn of day.

The flax fibers, which are remarkable for their strength, fineness and silky luster, are found on the inner side of the bark, next to the central woody core. The best flax has fibers as long as the stem, running from the flowers to the roots.

Flax requires the utmost care in all stages of its growth. It thrives best in a strong, rich, well-drained soil, from which all weeds have been removed by previous cultivation, but crops can be grown on new ground. A good yield cannot be obtained in a wet soil nor in one infested with weeds. Plants raised for the seed are mowed when they are ripe; those cultivated for the fiber have for ages been pulled up, root and stem, by hand, and before they have ripened. The reason for this is that the fibers become stiff and coarse if left too long, and cutting the stem with a mower would injure the best part of the fiber, which is found near the roots. Of late, many growers have adopted the quicker machine methods, notwithstanding the waste.



AVERAGE ANNUAL PRODUCTION OF FLAX
The figures by comparison represent the average year's production of flax fiber, the raw material of linen.

Removal and Preparation of the Fibers. When the stems have been pulled from the ground they are shaken free from dirt, tied into bundles, and drawn through iron teeth to remove the seeds at the top. This latter process is known as *rippling*. Next, the bark and inner core must be prepared for removal by a process known as *rotting*, or *retting*. That is, the stalks are steeped in running or stagnant water until the woody portions rot. Another

method, called *dew retting,* consists in spreading the stalks on the grass and exposing them to the action of the weather for several weeks. The stems are then dried so that the hard parts may become brittle.

Freeing the fiber from the stem requires two operations, *breaking* and *scutching.* In the first process the stems are pounded with mallets or run through a machine that breaks the hard portions to pieces but leaves the fiber

Figures Represent Millions of Bushels

FROM FLAX

The above figures represent the average annual production of linseed oil and linseed meal, from flaxseed, in the countries or provinces named.

intact. Scutching is for the purpose of removing the broken pieces of the stem. The old method, and the one still employed in some places, consists in laying the flax over the end of an upright board, which is fastened in a block, and striking it with a flat, wooden blade. This knocks off the woody matter clinging to the fibers and leaves them free. A scutching machine, in which a number of knives attached to the arms of a vertical wheel strike the flax in the direction of its length, accomplishes the same result, and is now in general use. Finally, the fibers are *heckled,* or *combed,* so they may be separated into "line" and "tow." The flax line is the long fiber, used in fine linens and the like; the tow, the short and coarse fiber used in making coarse linen, twines, cordage, etc. B.M.W.

Related Subjects. The reader is referred to the following articles in these volumes:

Adulteration of Foodstuffs and Clothing	Linseed Oil
Linen	Spinning
	Weaving

FLEA, *flee,* a troublesome wingless insect, some species of which pierce the skin and suck the blood of most all animals, leaving itching red spots. One species is found all over the world, tormenting cats, dogs, rabbits, poultry, and even biting human beings. Another species infests various birds. The true flea, so common in Africa and some European countries, which attacks human beings but does not attack animals, is rare in America, although it is found in parts of California. A flea called *chigoe* is troublesome in tropical America. Unlike other fleas which lay their eggs in the hair of animals, the female chigoe buries the forepart of her body in the flesh of human beings to lay her eggs there. That flea, however, is not the *jigger* of the Southern United States, which is the larva (young) of a mite.

So, naturalists observe, a flea
Has smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed *ad infinitum.*
—SWIFT.

The flea in the illustration is about twelve times the length of the insect.

Not only are fleas annoying, but it has been discovered that the bubonic plague (see PLAGUE) is transmitted through fleas from rats to man, as well as from one man to another. That fact suggested more careful study of this tiny, quick-jumping creature, so an exact wax model of the insect, 1,728,000 times the size of the living flea, has been made and is exhibited in the American Museum of Natural History in New York. In that model the biting parts of the insect are of special interest.

The common flea is about one-eighth of an inch long, somewhat flattened in shape and covered with a shell of hard, overlapping plates. In comparison with the body, the head is very small. Two threadlike feelers (antennae) lie in half-covered grooves behind the eyes, and can be lifted when needed. The beak consists of two inner and two outer parts. Between the two sawlike inner parts is a central part with a piercing point. The outer parts protect the inner ones. Two sharp-edged plates in front of the beak are used to help enlarge the wound made by the piercing parts.

Cleanliness is the best protection against this pest. If it has been brought into the home by animal pets numerous tiny, white, oval eggs will be laid and the number of fleas will soon increase, unless extreme care is exercised. From the eggs active, wormlike young will hatch. They will spin their silky cocoons in dust, and within about two weeks will appear as full-grown fleas. Thorough dusting of animals, rugs, etc., with pyrethrum, spraying with benzine and scrubbing with hot soapsuds will be effective. Spraying with oil of eucalyptus will also bring relief.

It is remarkable to note the cleverness of fleas which have been trained to do simple tricks. It is said that a wealthy man once paid $5,000 for such an insect. M.S.

FLEABANE, *flee'bane,* the popular name for several asterlike plants of the thistle family, so called from the mistaken idea, once strongly maintained, that they drive away or destroy fleas. *Canada fleabane,* also known as *horseweed, colt's tail, blood-stanch,* etc., is a weed common in waste places in Canada and throughout the northern Mississippi Valley. It is gathered when flowering and is carefully dried; in that form it is sold as *erigeron,* or fleabane, for stanching blood or for cases of diarrhoea and dropsy. It sells at from six to eight cents a pound. The fresh herb yields oil of fleabane. *Blue fleabane* is common in dry areas east of the Mississippi. It is also called *sweet scabious,* or *scabiosa,* and as a remedy for skin diseases is in great demand.

The old-fashioned cultivated *scabiosa,* or *mourning bride,* so-called because in Southern Europe the flower-heads are extensively used in making funeral wreaths, is a favorite garden plant whose tube-shaped florets of lavender, bluish-violet or pink are very attractive.

FLEM'ING, Sir Sandford (1827-1915), a Canadian engineer and publicist, the builder of the Intercolonial Railway, surveyor of the Canadian Pacific Railway's main line and inventor of the system of standard time. Fleming was born in Fifeshire, Scotland, but moved to Canada at the age of eighteen. He found a place on the engineering staff of the old Northern Railway, and in 1857 became its chief. A few years later he presented to the British government the request of the settlers in the Red River Valley for railway communication between Eastern Canada and the West. The result of this agitation was the Intercolonial Railway, whose right of way was laid out and its construction supervised by Fleming. On the completion of this work in 1871 Fleming became chief engineer of the railway now known as the Canadian Pacific, and by 1877 he had surveyed the entire route to the Pacific coast practically as it now exists. He also paid out of his own funds the expenses of locating a railway line in Newfoundland.

While these services made him a conspicuous figure in Canadian life, they should be regarded only as parts of his plans for consolidating the British Empire by railways, telegraphs and cables. As early as 1879 he proposed that an all-British cable should be laid to connect Canada with Great Britain on the one hand and Australia and New Zealand on the other; his plan, practically unchanged, was put into operation in 1902. After retiring from active engineering in 1880, Fleming returned to the problem of universal or cosmic time in which he had always been interested. As a result of his studies he proposed the system of standard time (which see), which is now in general use. Though not a politician in any sense, he took a very active interest in political affairs and frequently contributed vigorous articles on public questions to the periodicals. From 1880 until his death he was chancellor of Queen's University. He was an active member of numerous learned and scientific societies, and served in 1888 as president of the Royal Society of Canada. In 1897 Queen Victoria created him a Knight Commander of the Order of Saint Michael and Saint George. G.H.L.

FLEM'ISH LANGUAGE AND LITERATURE. The Flemish language is a form of Low German, spoken by a large number of the inhabitants of Belgium, especially in the provinces of East Flanders, West Flanders, Antwerp, Limburg and Brabant, and in parts of the Netherlands. It is closely related to the official language of the Hollanders, but retains several peculiarities of spelling and pronunciation not found in modern Dutch.

The history of Flemish literature is practically the history of Dutch literature until the separation of Belgium from Holland in 1830. When the revolution of that year made Belgium an independent state, French had long been used in government circles, and the Flemish language existed in the Low German provinces only in the form of spoken dialects.

About 1830, however, there began a remarkable movement for the revival of Flemish language and literature, and this movement was greatly aided by various laws passed by the Belgian government, whereby Flemish was put on an equal basis with French as the legal and official language of the kingdom. Moreover, Flemish was added to the course of study in the public schools, and in 1886 a Flemish Academy was established at Ghent. The Flemish movement produced many writers of distinct merit, and the revived Low German literature is represented by novels, poetry and plays.

FLETCHER, John. See Beaumont and Fletcher.

FLETCH'ERIZING, a method of masticating the food, which has been emphasized by

Horace Fletcher (born 1849), an American lecturer and writer. When Mr. Fletcher was forty years of age he was, according to his own statement, a physical wreck, and it was with the hope of regaining his health that he devoted himself to a study of the problem of nutrition. His theory, in brief, is that all bodily ills can be corrected by the proper mastication of one's food—that all solid food should be chewed until it is reduced to a liquid condition, when it will "excite in an irresistible manner the impulse to swallow." This is what Fletcher terms *natural mastication*, as a result of which the food "swallows itself." Moreover, food of every sort, liquid or solid, should be held in the mouth until all the good taste which it possesses has been extracted. He also believes that over-eating and eating at the wrong time are as much to be condemned as hasty eating, and that all three demoralize the digestive apparatus and lead to innumerable bodily ills. Never partake of food, he advises, unless a natural appetite for it has been created, and then cease to eat when the appetite "begins to slack up." With proper mastication poisons are eliminated from the body and fatigue is prevented, and the net result is a high standard of health, vigor of mind and body, and immunity from disease.

The benefits derived from thorough mastication are recognized by all physicians. Some, however, believe that Mr. Fletcher takes an extreme position that is open to criticism. The excessive secretion of saliva that results from prolonged chewing is held by some of his critics to be unwise, and may cause the teeth to decay and the gums to be diseased. Furthermore, his system tends to reduce not only the amount of food eaten, but the variety, and students of nutrition hold that the human organism demands a wide range of food. On the other hand, the people owe him their gratitude for having stimulated interest in the subject. He has done more than any other person to focus public attention on the evils of hasty eating and on the general problem of nutrition. See FOOD; DIGESTION; MASTICATION.

FLEUR-DE-LIS, *flur de lee'*, the national flower of France, more generally known as the *iris*. The emblem of the French kings, a conventionalized form of iris, was also called fleur-de-lis. Many legends are related as to the origin of this emblem, but it was King Charles VI who definitely fixed the French coat-of-arms as three golden fleurs-de-lis on a blue field. As a compliment to this king the practice was adopted, and still exists, of marking North on the card of a mariner's compass by a fleur-de-lis.

The plant has large, sword-shaped, rushlike leaves, and flowers with three outward curving

FLEURS-DE-LIS

petals and three smaller, inwardly arched parts. The colors range from white and yellow to mauve and purple, appearing in many beautiful combinations. It is found both cultivated and wild. Longfellow says of it:

Born in the purple, born to joy and pleasure,
Thou dost not toil nor spin,
But makest glad and radiant with thy presence
The meadow and the lin.

FLEXIBIL'ITY, a property of certain materials that makes it possible to bend them to a varying degree without breaking them. *Elasticity* causes the material bent to resume its former shape when the strain is removed. Flexibility, however, does not necessarily imply more than bending. A thin bar of iron is flexible; a bar of steel of the same thickness is generally both flexible and elastic. Flexibility enables a bow to be readily bent, but it is elasticity that causes it to spring back into position and propel the arrow. See MATTER, subhead *Properties of Matter*.

FLICKER, *flik'er*, one of the handsomest and most common birds of the Eastern United States and Southern Canada, known popularly as the *golden-winged woodpecker*. The name *flicker* is supposed to have been suggested by

its queer, loud note, which sounds a little like that word. It nests in holes of trees, and from the position of its nest it is also called *high-hole* or *high-holder.*

THE FLICKER

This bird is sometimes a foot long, with a long, slender and smooth curved bill; its prevailing color is olive-brown, with black markings. The head and neck are ash colored, the head showing a bright scarlet crescent. The under parts are brown, fading into yellow below the legs, and marked with round, black spots. Across the breast and throat is a broad black bar. In addition to all this, the under parts of the tail and wings are a rich golden yellow, and the rump and tail coverts are pure white, showing plainly when the bird is flying. The flicker feeds on worms, insects and berries; he is the farmer's friend, because he does little damage in comparison with the pests he destroys. He taps for his food, as do all woodpeckers; unlike that family of birds, however, this species also often feeds on the ground, and is sometimes mistaken for the meadow lark.

The flicker nests as far north as Central Alaska and east to the Canadian Atlantic section; it migrates from Canada in early fall, but in parts of the United States it is a permanent resident. The migration extends as far south as the Gulf coast.

FLINT, the mineral used by our forefathers for striking with steel to produce fire. It is a variety of quartz and usually is of a dark bluish-gray color. It is found in rounded lumps, called *nodules,* in masses of other rock. It is very hard, and when struck against steel produces a spark. It was the spark thus formed that set fire to the powder in the flint-lock musket of Revolutionary times. It is used now in the manufacture of some varieties of glass and in pottery of a high grade.

FLINT, MICH., locally known as the VEHICLE CITY, because of its extensive automobile industry. It is situated south and east of the center of the state, in Genesee County, of which it is the county seat, and is fifty miles northeast of Lansing, the state capital, thirty-four miles southeast of Saginaw and seventy-three miles northwest of Detroit. It is on the Flint River, and on the Grand Trunk and the Pere Marquette railroads. An interurban line extends north to Saginaw and Bay City and another runs south to Detroit. The area of the city exceeds twelve square miles. The population in 1910 was 38,550 and in 1916 it was estimated by the Census Bureau to be 54,772. About seventy-five per cent of the inhabitants are Americans, and among the foreign-born are people of almost every nationality.

Flint is the home of the Buick Motor Car Company, and of the assembling plants of the Dort, Monroe, Chevrolet and Paterson automobile companies. In addition to these automobile plants, the city also contains manufactories of motors, carburetors, flour, woolen goods, cigars, paint and varnish, wheels, bicycles, iron, brick, tile and lumber products. There are large coal mines in the vicinity. The city is an important grain market.

Noteworthy buildings are a fine courthouse, a Federal building costing $100,000, city hall, Carnegie Library, banks, churches and two hospitals; one of these, Oak Grove, is a private institution for the treatment of mental disorders. There are twelve parks containing altogether 100 acres. In 1854 the Michigan School for the Deaf was established here. There are a number of business colleges and parochial schools, in addition to the public schools.

The first settlement, called Grand Traverse of the Flint, was made in 1820. It was incorporated as a village in 1831 and chartered as a city in 1855. The rapid growth of the place since 1869 has been due to the development of the vehicle industry. E.B.L.

FLODDEN FIELD, in Northumberland, England, near the Scottish border, is historically interesting as the scene in 1513 of a battle between the Scots, under James IV, and the English under the Earl of Surrey, as the representative of Henry VIII. An account of this conflict, in which the Scots were courageous but unsuccessful, may be found in Sir Walter Scott's *Marmion.* The Scottish dead numbered 10,000, and included the leading men of the kingdom. It is said that every family of importance lost one or more of its members.

FLOOD, *flud,* a body of water covering land not usually submerged. It is sometimes beneficial, sometimes destructive. The annual flood

of the Nile, which deposits on the plains of Egypt fertile soil from regions farther south, has enriched the country and has built the world's greatest oasis, and there are many lesser instances of a similar nature (see NILE). Sudden and violent floods bring huge losses, and the study of means of prevention is a task of growing importance. River floods are more frequent than sea floods, though not more serious.

River Floods. The Mississippi and its tributaries and the Hoang-ho, or Yellow River, in China, are noted for their tendency to overflow their banks. The Hoang-ho flows through a channel raised above the level of the surrounding plain partly by nature, partly by man-made dykes. When it breaks its banks it sometimes devastates an area as large as Great Britain. After each flood the river takes a new course; in the last 2,500 years its mouth has shifted over 200 miles, or nearly a mile every twelve years. Floods in the Mississippi basin are caused by excessive rainfall and sudden melting of snow and ice. The Upper Mississippi is not subject to them, but its lower course and its branches, the Ohio and the Missouri, frequently overflow.

The greatest flood in American history occurred in the states of Ohio and Indiana in April, 1913, in valleys tributary to the Ohio, principally along the Miami. It is commonly thought that such floods are due to the partial blocking of the river by bridge piers, filled land, sandbars and other obstructions, but engineers say that these are but minor sources of the trouble; the real difficulty lies in the fact that the natural channel of the Miami will hold only one-tenth as much water as it is sometimes given to carry; there are many other rivers even less capable of the work they may be called upon to do.

River lands become more liable to flood as the higher land surrounding them is stripped of trees and other vegetation, for then a heavy rainfall runs off rapidly and a river must do in a day the work of weeks in ordinary times. So tree planting is recommended as the first step in flood prevention. Also, reservoirs may be built which will hold back the water until the river can carry it off. The danger here is that a second great flood may immediately follow the first, overflowing, perhaps bursting, the reservoir. What would happen then is instanced by the very disastrous [illegible]town (Pa.) flood in 1889. Levee building [illegible] common step. Much of the Mississippi below Cairo, Ill., is bordered by levees, but these frequently break and allow the stream to spread out, in some places to a width of seventy miles. On such occasions the damage to property is often millions of dollars.

Seacoast Floods. Floods from the sea are most frequently due to the piling up of the waters by high winds. Holland, which is partly below sea level, protects itself from them by its famous dykes, which in modern times seldom fail. In other regions such tidal waves come unexpectedly, and there is no provision against them. After its great flood of 1900, Galveston built a sea wall, but in the storms of 1915 this proved insufficient to protect the city completely. Earthquakes and volcanoes also produce waves, sometimes a hundred feet high. There have been notable instances of them at Lisbon, Messina and in Japan; at the eruption of Krakatoa in 1883 a large vessel was swept inland a mile and a half and stranded thirty-nine feet above the sea. R.D.M.

Related Subjects. The reader is referred to the following articles in these volumes:

Earthquake	Lisbon
Hoang-ho	Mississippi
Johnstown, Pa.	Netherlands
Levee	Nile

FLOOD PLAIN, a term used in physical geography to describe a plain formed of sediment deposited by a river. Floods in high regions carry off quantities of earth and other matter, which are deposited lower down in the plains by the flooding of the river channel. The overflowed waters lie practically still on the surface of the land and a natural deposit occurs. This is clearly illustrated along the banks of the Mississippi River, where flood plains covering an area of 50,000 square miles have been formed by the deposits from the often-flooded river. In the case of the Mississippi flood plains, the deposits are so light that the river is constantly washing out new channels.

The nature of the deposit varies greatly, and is governed by the violence of the flood and the nature of the country through which the stream passes. A raging torrent will carry gravel, stones and even small rocks, while a flood of less violent proportions might carry only light gravel; sluggish waters would contain only fine silt, slowly carried along. A flood plain may be caused by a bank or bar across the river mouth, which compels the river to drop its load, which gradually accumulates until sometimes it forces the river

from its original channel. The Rhine, Nile, Po and the Ganges are remarkable for their flood plains, but in none of these cases is the action of the river in forming them so clear as in the Mississippi.

FLO'RA, in Roman mythology, the goddess of springtime and flowers, whose temple at Rome was located near the Circus Maximus. Her annual festival, called the *Floralia,* began April 28 and lasted for six days, and was characterized by excessive hilarity and abandon. She is represented in art as a flower-bedecked and beautiful maiden, usually holding a cornucopia.

In botany the word *flora* signifies all the plant life of a region, as *fauna* signifies the animal life.

FLORENCE, *flawr'ens,* famed as the center of Italian culture when it was at the height of its glory, is one of the world's most interesting cities. It is situated in Central Italy, at the base of the Apennine Mountains, 140 miles northwest of Rome, and is built on both banks of the winding Arno, whose fertile valley, covered with vineyards, groves and orchards, affords the city an ideal location. Florentines call it *Firenze la Bella* ("Florence the Beautiful"), but it might also be called the "City of Famous Men," for with its wonderful past are connected the names of Dante, Petrarch and Boccaccio; of Cimabue, Ghirlandaio, Andrea del Sarto, Filippo Lippi and Leonardo da Vinci, the painters; of Michelangelo, Luca della Robbia, Donatello, Ghiberti and Cellini, the sculptors; of Brunelleschi, the architect; of Machiavelli, the statesman; of Galileo, the philosopher; of Savonarola, the theologian; of Americus Vespucius, the navigator; of Lorenzo de' Medici, patron of art and literature, and of many others, sons of Florence either by birth or by adoption.

Famous Structures. The view of Florence from the Viale dei Colli (Road of the Hills), a magnificent carriage-way passing along the hills to the south, is one of striking beauty. Perhaps first to attract attention would be the three buildings in the Piazza Duomo (Cathedral Square)—the beautiful Cathedral of Saint Mary of the Flower, the graceful Campanile, or bell tower, of Giotto, and the historic eight-sided Baptistery, with Ghiberti's wonderful bronze doors. The Arno, dividing the city into unequal parts, is spanned by six bridges, four of which are old stone structures in the medieval style. The Ponte Vecchio (Old Bridge) is of particular interest, because its thoroughfare is still bordered with quaint, rambling houses of the goldsmiths, built in the Middle Ages. It has an upper passageway connecting the city's two famous art palaces—the Uffizi and the Pitti. Another structure of special interest is the Palazzo Vecchio (Old Palace), once the seat of government of the republic of Florence, and now containing the city's government offices. This is an imposing building surmounted by a lofty tower, the great bell of which was once used to warn the people of danger. Many churches and palaces associated with memories of the old days are still in use, and so, too, is the old monastery of San Marco, of which Savonarola was prior.

Art Treasures. The art of Florence held a supreme position among the schools of the Italian Renaissance, and the great Pitti and Uffizi palaces (each described in these volumes under its title) contain collections of priceless value. In the Church of San Lorenzo may be seen the famous statues over the tombs of Giuliano and Lorenzo de' Medici, the work of Michelangelo. There are reproductions of these in plaster in the Art Institute of Chicago. The city's oldest church, Santa Maria Novella, contains paintings by Cimabue and frescoes by Filippo Lippi and Ghirlandaio, and the famous angel figures executed by Fra Angelico are on the walls of the monastery of San Marco. One of the most notable of the artistic treasures of Florence is the dome of the great Cathedral. This was so much admired by Michelangelo that he used it as a model for that of Saint Peter's at Rome. The church contains sculptures by Ghiberti, Luca della Robbia, Michelangelo and other famous artists. Among other celebrated works are the tombs of Michelangelo, Machiavelli and Galileo, in the Church of Santa Croce (Holy Cross). Here, too, is the empty sepulcher of Dante.

History. Florence was probably founded as a Roman colony late in the second century B. C. During the Middle Ages it became a prosperous commercial city, and the headquarters of money-changers, jewelers and goldsmiths. Between 1282 and 1530 a republican form of government was maintained, and at various times powerful merchant guilds or wealthy families were at the head of affairs. The famous family of the Medici continued in power from 1434 until 1737. After the fall of the republic a ducal government was established by Emperor Charles V, one of the Medicis being created Duke of Florence. In 1569 Flor-

ence became the capital of the Grand Duchy of Tuscany, and after the new kingdom of Italy was constituted it was for a time the seat of government (1865-1871). It is now the capital of the province of Florence. In 1915 the city and suburbs had an estimated population of 242,147. B.M.W.

FLORENCE, ALA., an important manufacturing center, and the county seat of Lauderdale County, situated in the extreme northwestern part of the state, on the Tennessee River, at the foot of Muscle Shoals Canal. Birmingham is 125 miles southeast, Nashville is 125 miles northeast; Chattanooga is 150 miles northeast, and Memphis is 150 miles northwest. Two railroad lines, the Louisville & Nashville and the Southern railways, provide transportation. Electric railways operate between Florence, Sheffield and Tuscumbia, and steamboats connect with Chattanooga, on the north, and the Gulf of Mexico, on the south. The town was laid out in 1818 by an Italian from Florence, and he named it for the famed Italian city. In 1889 a city charter was granted, and in 1914 the commission form of government, with three elective officers, was adopted. The population in 1916 was 6,689.

The city is located on a plateau 200 feet above the river, which at this point is spanned by a steel bridge. Wildwood Park of 250 acres, a large Indian mound and an old military road through the city, cut out by General Andrew Jackson from New Orleans to Nashville, are features of interest. The most notable buildings are a $140,000 Federal building, completed in 1914, and the Jefferson Hotel. The state normal school was erected at a cost of $85,000; the girls' dormitory, built in 1913, cost an additional $75,000. This and the Burrell Normal School, the Florence Synodical Female College, Mars Hill Academy and a library offer excellent advantages for higher education.

Florence is situated in a coal, iron and lumber region, and though the manufacture of pig iron, boilers, engines, wooden pumps and wagons is extensive, the people are largely engaged in cotton and fertilizer industries. The water power of the Muscle Shoals at this point is considered second only to that of Niagara Falls, and plans are under way for developing this power by the construction of three dams, which will greatly increase manufacturing facilities. E.J.

FLORIDA, the "land of flowers," the winter playground of Eastern America, the home of the pineapple and of a large part of the tropical fruit supply of the United States, is the southernmost state of the American Union. As five-sixths of its length, or 375 miles, with an average width of about ninety-five miles, is almost entirely surrounded by water, it is called the *Peninsula State*. The name *Florida* is the Spanish word for *flowery*, and was given by Ponce de Leon, who discovered it on Easter Sunday, which in Spanish is called *Pascua florida*, or *flowery Easter*.

Alabama and Georgia touch its almost straight northern boundary of about 400 miles; and dividing it from Alabama on the extreme northwestern corner is the Perdido River. On the east is the Atlantic Ocean, on the south and west, the Gulf of Mexico. A chain of islands extending in a curved line 200 miles along the coast at the south, called the Florida Keys, is included within these boundaries. Florida has the longest coast line of any state —almost 1,200 miles—more than half the distance between Chicago and San Francisco. Covering an area of 58,666 square miles, it is about the same size as Georgia, but has less than one-third the population, this being reported as 904,839 on January 1, 1917. The province of Alberta is over four times the size of Florida, but its population is only a little over three-fifths as great.

The People and the Cities. Over forty-one per cent of Florida's population is colored. Of the remainder, about 34,000 were foreign-born —from the West Indies, England, Germany,

Italy, Canada and Spain—and there are fewer than 400 Indians left in the state to represent the historic race of Seminoles.

Tallahassee, in the extreme north-central portion of the state, is the capital. The largest cities are the harbor cities of Jacksonville, Tampa, Pensacola and Key West. In those four cities almost one-fifth of the state's population is concentrated, busy in the shipping of fruits, cotton, cigars, lumber and forest products and vegetables. Naval stations are maintained at Key West and Pensacola.

Land Surface and Waters. Excepting Louisiana, Florida has the lowest average elevation above sea-level of any state in the American Union. Its greatest height is a central divide, a ridge from 100 to 274 feet high, which separates the rivers flowing into the Atlantic from those flowing into the Gulf. Over six per cent of the area of the state is water.

The northwestern part of Florida, an extension of Alabama uplands, is a hilly, rolling country. The coastlands are low, level, and in many places marshy, with numerous sand and coral reefs and narrow islands, which enclose long, shallow lakes, lagoons, rivers and bays, such as Indian River and Lake Worth, on the east coast. The most remarkable coral formations are the Florida Keys.

Florida might be called the state of lakes, for within its central region there are estimated to be 30,000 lakes, most of them very shallow, however, and due to sinkholes or hollows in limestone. The largest of these, Lake Okechobee, is described under its title in these volumes. To the east of Lake Okechobee lies the world-famed Palm Beach. Others of the larger lakes are Orange, Apopka, Kissimmee, Istokpoga, Tohopekaliga, Crescent and George.

South of Lake Okechobee a large part of the peninsula is covered by the Big Cypress Swamp and the Everglades. The presence of these vast grass- and cypress-fringed swamps and of the Everglades, which alone cover an area of 5,000 square miles, or over eight per cent of the area of the state, has given to Florida the name of *Everglade State,* as well as *Peninsula State,* mentioned above. For many years work has been conducted to affect the drainage of the Everglades to reclaim the land for agricultural purposes, and in 1913 a state appropriation of $6,000,000 was made toward that end.

Among Florida rivers, Saint John's is one of the most important. For almost 400 miles it winds its way northward from Lake Washington, near the east coast at about the middle of Florida, and passes through several other lakes until it enters the Atlantic Ocean. Its course, bordered with semi-tropical vegetation, is a delight to tourists. Another beautiful

OUTLINE MAP OF FLORIDA

Here are shown the boundaries, principal rivers, chief cities, mineral deposits and the highest point of land in the state.

river is Ocklawaha, in the center of the state. Other rivers of importance are Saint Mary's, forming part of the boundary between Florida and Georgia; the Caloosahatchee, which, connected with a drainage canal through Lake Hicpochee, drains Lake Okechobee into the Gulf of Mexico; the Kissimmee, flowing southward into Lake Okechobee; the Peace, flowing into Charlotte Harbor on the west coast; the Suwanee, crossing the state from the north, and the Apalachicola, an extension of the Chattahoochee and Flint rivers of Georgia. Two smaller rivers, the Withlacoochee and the Hillsborough, have recently been developed to furnish electric and water power. The Suwanee, famed in the song known in every household, is a small, unimportant and not especially beautiful stream.

Throughout the state are numerous springs and underground streams connecting lakes. Some of the springs contain health-giving properties and are visited by invalids from all parts of the world. Wakulla Spring in the northwest, probably the largest spring in the world, is about 500 feet wide and 100 feet deep. Not far from Saint Augustine, on the

east coast near the north, two miles out at sea, one spring comes to the surface with such force that ocean waves roll back from it as though it were a low reef. It has been estimated that about 400 tons of limestone are worn away each year by Florida's springs.

Harbors and Coast. The eastern shore line is very even, but, as it is bordered with numerous sand reefs, it has a few good harbors. Biscayne Bay at the extreme south, and the harbor of Saint Augustine near the north, are used to some extent by merchant vessels. The mouths of the Saint Mary's and Saint John's rivers, near the north, have been improved so that vessels can steam as far as Fernandina on the former and Jacksonville on the latter.

The western coast has the best harbors, and large vessels enter Charlotte Harbor and the bays of Tampa and Pensacola. Among the Florida Keys are numerous good harbors, but the one at Key West, on the westernmost key and actually west of Tampa, is the most important commercially. At Ormond, about fifty miles south of Saint Augustine, the beach is smooth and hard and is a favorite spot for automobile races.

Climate, Vegetation and Animals. Florida is a state of even and healthful climate. It lies far enough south to be almost entirely free from severe cold, and summer heat is modified by the ocean on one side and the Gulf on the other. The average winter temperature is 60°; frost is almost unknown. In summer the average temperature is 78°, and the thermometer rarely rises higher than 90°. Summer is said to last two-thirds of the year, and there are on an average 250 clear days. A daily paper in Saint Petersburg advertises that it makes no charge to its subscribers for their papers on days when the sun does not shine in that city; it has very few "free days."

June, July and August constitute the rainy season, and the rainfall is heavy, being fifty-five inches at Jacksonville and over sixty inches in some places on the gulf coast. Though fevers occur in some sections, there are so many delightful spots that Florida has become the winter playground of the North and a sanitarium for thousands of invalids. Those afflicted with throat or mild lung diseases find the dry pine regions especially beneficial.

This state is rich in subtropical vegetation. It is a place of royal palms and flowers in luxuriance almost the year round; with regions abounding in orange trees (the fragrant orange blossom being the state flower) and fig, lemon, guava, pomegranate, banana and olive trees, pineapple, tobacco and sugar cane plants. In the forested spots, which cover a large portion of the state, are found cypress trees, long-leaf pines, live oaks, great masses of curious mangroves, and numerous other trees of value and interest. In addition to bright-hued birds like herons, flamingos and parrots, with their gay attire, there is much to attract the sportsman. Wild turkeys and game birds are abundant. Deer, raccoons, opossums and a small species of black bear are found. Alligators and turtles and tarpon, shad and other game fish fill the waters. Rattlesnakes, poisonous serpents and insect pests are also abundant in certain sections. Yet to many lovers of the wonders of nature, Florida is a place of enchantment, a "land of delicious lights and floating shades."

The Land and Its Products. Florida has the distinction of growing over ninety-nine per cent of some of the tropical crops of the United States, namely, avocado pears, bananas, kumquats, limes and pineapples. It is the home, too, of the grape fruit and the tangerine, of which its production is nine-tenths of the nation's. More important, though, is the orange yield, which is only one-third that of California but brings the state several million dollars each year. Peaches, pears, pecans, grapes, figs, plums and prunes, lemons, guavas, mangoes, apples, persimmons, walnuts, mulberries and cocoanuts are also raised.

The crop which brings the largest return to the state is corn, of which about 12,000,000 bushels are produced each year—twice the amount harvested in 1905. Sea island cotton and peanuts add several million dollars to the wealth of the state each year, and sweet potatoes, potatoes, sugar cane and tobacco are nearly as profitable. But next to the fruit yield in importance are the vegetables, which are grown for the early demands of Northern markets. Tomatoes bring the largest total returns, but distinctive crops such as eggplant, green peppers and okra are receiving increasing attention.

Stock raising is an important branch of agriculture, horses, mules, pigs, sheep, milch cows and other cattle being numerous. The timber lands of Florida are of vast importance, large quantities of such products as pitch-pine, tar, turpentine and rosin being exported each year.

Minerals. There are comparatively few minerals in Florida, but phosphate rock is found almost everywhere in the state. In some sec-

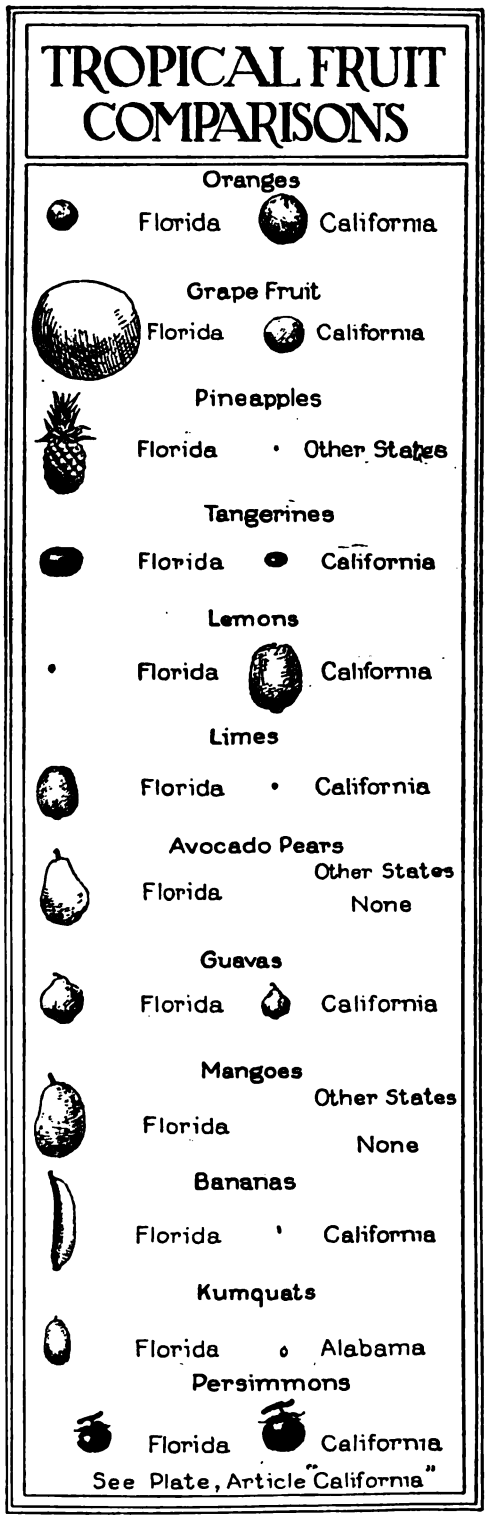
tions it is mined in great quantities and exported for fertilizer. Florida ranks first in quantity and value of this rock, with an annual output of over $9,500,000, an average of about $32,000 each working day. Fuller's earth is an important product, Florida being the first state in the Union in its production. Kaolin, lime and mineral waters are also of some commercial importance. Mineral products of the state were valued at over $10,508,000 in 1913; in 1914, $8,497,688.

Fisheries. Florida has extensive fisheries along its coast line, which are more important than those of any other Gulf state, although they are not fully developed. Shad, red snappers, mullet and turtles are the chief fishery products, and Florida has almost a monopoly on the American production of sponges. Alligators are also sought for their skins, and there are several profitable "alligator farms." Pensacola is said to be the most important fresh fish market on the Gulf. Florida fisheries are valued at almost $3,400,000 a year, on the average, and nearly 6,000 fishermen are employed.

Other Industries. Key West and Tampa compete with Cuba in the making of cigars and cigarettes, although most of the tobacco leaf used is imported from Havana, Cuba. The yearly tobacco output is estimated at about $20,000,000. The importance of the manufacture of tobacco products in Tampa and Key West is described under those titles. Next in importance are the manufactures of lumber and forest products. The output of lumber, timber, turpentine and rosin exceeds $30,000,000 a year. The next industry in size, the preparation of fertilizers, is much smaller. Florida holds first place in the production of turpentine, pitch and rosin. North Carolina, which once held first place, has fallen to sixth.

Convicts in prison camps in lumber regions and near phosphate quarries do most of the labor in those two industries, and are hired to the highest bidder. There is no penitentiary in the state, but there are two state prison farms.

Transportation and Commerce. Florida has excellent facilities for transportation, both by land and water, even though there are few harbors of the first class. Intercourse between all of the important cities of the state and with the principal commercial centers of the North is rapid and convenient. The distance from New York to Jacksonville is little more than from Chicago to New York, and from



Charity. There are thirty-three charitable institutions in the state, among them being schools for the deaf, dumb and blind, the Confederate Soldiers' Home, hospitals and industrial homes. There are also state asylums for the insane, and almshouses. Each county provides its own poor relief.

Government. Florida is governed under a constitution which dates from 1886. The legislature consists of a Senate with thirty-two members chosen for four years, and a House of Representatives of sixty-eight members chosen for two years. The Senate is changed by the election of one-half its membership every two years. Sessions are held every other year and are limited to sixty days.

The governor is elected for four years and is not eligible to succeed himself. A secretary of state, an attorney-general, a comptroller, a superintendent of public instruction and a commissioner of agriculture are the other state officers. Each serves for four years. A supreme court with five justices serving for six years, circuit courts and courts of inferior jurisdiction administer justice. For local government the state is divided into forty-eight counties, each with five commissioners and a sheriff, who, with other county officers, serve for two years.

Payment of poll taxes is a qualification for voting. In 1913 the direct primary was adopted by the state. The legal holidays of Florida are New Year's Day, Robert E. Lee's and Washington's birthdays, Memorial Day, Jefferson Davis's birthday, Independence, Labor and general election days, Thanksgiving and Christmas. Shrove Tuesday is a legal holiday in cities and towns where carnival associations are organized for celebrating that day.

History. From the landing of the Spanish adventurer, Ponce de Leon, at Saint Augustine, April 2, 1513, in search of the fountain of perpetual youth, until 1819, the history of Florida is chiefly one of Spanish exploration and possession. During those 306 years numerous Spanish exploration expeditions met with hardship and failure. The expedition of Narvaez, about 1528, is of interest because only four of his band, headed by Cabeza de Vaca, succeeded in reaching Mexico; that of De Soto, eleven years later, because it resulted in the discovery of the Mississippi River.

In 1562 and 1564 Huguenots (Protestants from France) attempted settlements in Florida on the Saint John's River, but the Spaniards erected a fort at Saint Augustine and massacred the colonists. In 1586, Sir Francis Drake, on one of his plundering expeditions, burned Saint Augustine, but the Spaniards retained their hold on the country and founded Pensacola about 1699. Then English colonists from Carolina and Georgia commenced to enter the territory which Spain regarded as its own, and disputes continued until, by the Treaty of Paris in 1763, which ended the French and Indian War, East and West Florida were ceded to England. (West Florida lay west of the Apalachicola River and included parts of present Alabama and Mississippi.) Twenty years later this territory again became the possession of Spain. After that time conditions in Florida menaced the peace of the southern borders of the United States. It was the refuge of runaway negroes, plundering Indians and dangerous adventurers. Disputes and battles ensued, and in 1819 the United States obtained possession of Florida by treaty. For seven years war was waged with the Seminole Indians, after which they were given lands west of the Mississippi. In 1845 Florida was admitted to the Union as the twenty-sixth state.

In 1861 the state seceded from the Union and joined the Confederacy, but Federal forces easily captured coast towns. In 1864 it was again lost to the Union, but the next year the ordinance of secession was repealed, and in 1868 a new constitution was framed, under which the state was readmitted to the Union. The part played by the state in the Presidential election of 1876 was important, and resulted in the election of Rutherford B. Hayes (see ELECTORAL COMMISSION). Since that time Florida has been generally Democratic.

The reclamation of swamp lands, the discovery of phosphate deposits and the growth of fruit-growing industries have aided the development of Florida and have brought Northern capital and population to the state. The tobacco industry has called people from Cuba. The most notable disasters were the frosts of 1894, 1895, 1899, 1906 and 1917, which destroyed millions of dollars worth of fruit, and the hurricane at Key West in October, 1909, which destroyed property and injured many people. M.S.

Other Items of Interest. Sidney Lanier wrote a delightful sketch called *From Morn Till Night on a Florida River,* which describes a trip on the Ocklawaha and makes very real the charm of Florida scenery.

RESEARCH QUESTIONS ON FLORIDA

(An Outline suitable for Florida will be found with the article "State.")

If the lakes of Florida were evenly distributed among the states of the Union, how many would each state have?

Allowing 31½ gallons to a barrel, how many barrels of water does the Silver Spring pour out in one hour?

How does the state manage to obtain a revenue from its convicted criminals?

Who discovered Florida? For what was he searching at the time? What other famous explorers visited the region?

What part did certain tiny sea animals have in determining the coast line and the neighboring island formations of this state?

What enterprise in Saint Petersburg which really has nothing to do with the weather would suffer financially if there were a "run" of cloudy weather?

If the chief manufacturing industry of the state were abandoned, who would miss the product most?

What is Shrove Tuesday? How is it celebrated in Florida and in a number of the other Southern states?

How many states are lower in average elevation? How many states have "highest points" which are less lofty than that of Florida?

Where is there a much-used natural automobile race course?

Of what very useful sea product does this state have practically a monopoly?

How many of the states east of the Mississippi are larger than Florida? How many have a larger population?

How large a proportion of the inhabitants live in the four largest cities?

What effect do the sand reefs along the eastern coast have on the commercial possibilities of the state?

How does Florida help the farms of other states to be more productive?

What is the chief difference between the prairies of Florida and those of the Central and Western states?

Who were the most important Indians of the Peninsula? Tell something of their history. About how many are left in the state?

How does Florida's largest spring rank as to size among the springs of the world? What shows graphically the force with which some of these springs reach the surface?

Is the crop which brings to the state the largest returns a subtropical product, or is it grown in the cooler regions?

What does the name of this state mean? Why was it given? Account for two popular names.

What river, not especially important, is known by name as widely as any of the world's greatest rivers?

How long does it take to go from New York to Florida's most famous winter resort? From Chicago?

To how many nations has the territory comprising Florida belonged?

If the coast line of this state were straightened out, how far westward from New York would it reach?

Of what tropical or semi-tropical products does this state grow practically all that is produced in the United States?

flour and whole-wheat flour are marketed to a considerable extent. The former, named for Sylvester Graham (1794-1851), an American reformer and advocate of vegetarianism, is unsifted wheat meal ground from the entire kernel. Whole-wheat flour contains all of the kernel except the coarser portions of the bran. The bran itself, constituting the outer coats of the wheat kernel, is now being extensively used to give bulk to food, and as a laxative—it is Nature's remedy for constipation. Graham and whole-wheat flours compare favorably with white flour in composition; in common with bran, which ranks low in nutritive qualities, they are more laxative than fine white flour. Gluten flours, from which nearly all the starch has been eliminated, are considered of value in certain forms of dyspepsia and diabetes.

How Flour Is Made. The modern process of flour milling consists in separating the outer bran layers from the inner portion of the wheat kernel by repeated grindings, and in purifying the broken inner portion (the middlings) until a pure white flour is secured. The wheat is carried to the top of the mill in elevators, and then passed through several machines which remove all particles of dirt, weed seeds, chaff and other impurities, and free the kernels from fuzz and hair. If the kernels are too dry and brittle the bran will split up into tiny pieces and spoil the flour during the reduction process, and so it is often necessary to dampen, soak or steam the wheat in order to moisten the outer layer. When these processes are completed the cleaned wheat is again elevated to the top of the mill, weighed there by automatic machinery and then passed through the various grinding machines, or rollers.

There are usually five sets of rollers, and the passage of the grain through each is known as a *break*. At one stage of the process the germ of the wheat kernel is removed, for that portion contains fat which is liable to become rancid and spoil the flour if permitted to remain. After the first grinding the crushed wheat is separated into (1) first-break flour, (2) middlings, consisting of portions of the inner part of the kernel and of fine pieces of bran, and (3) bran and unbroken wheat. The unbroken wheat is then passed through the next set of rollers, and after the second break separated as before into flour, middlings and bran. The middlings from each break are subjected to a purifying process, in bolting, [redacted] and scalping machines, being gradually separated from the bran and other by-products of the wheat, and the purified middlings are finally reduced to a fine white meal, forming the high-grade first-patent flour.

Portions of fine flour yielded by the various breaks, which are more or less mixed with impurities, become the red-dog or low-grade flour, and the impure middlings accumulating during the successive grindings form what is known as *baker's flour*. It is customary, too, to blend the different streams of break flour and middlings flour to form special commercial brands. The finished product is finally fed into a machine which packs it into sacks or barrels. The former hold a half barrel, quarter barrel and eighth barrel, and a barrel contains 196 pounds.

Statistics of the Industry. Minneapolis, Minn., which is in the famous spring-wheat region of the Valley of the Red River of the North, is the most important flour-milling center in the world, and its Pillsbury "A" Mill, which has a capacity of 15,000 barrels every twenty-four hours, is the largest mill anywhere in operation. The combined capacity of the mills of the city is more than 86,000 barrels a day. Other important centers are Kansas City, Mo., Buffalo, New York, Duluth, Saint Louis, Philadelphia, Milwaukee, Chicago, Detroit, Rochester and Cincinnati. There are in the United States about 7,500 manufacturing establishments which supply the home market and also export flour in large quantities, besides numerous smaller mills (gristmills) which grind wheat, corn and other grain provided by neighborhood farms. The value of the annual product of American flouring mills is about $900,000,000. The total output is about 107,000,000 barrels a year.

Canada is also an important flour-manufacturing country, having over 1,140 establishments producing flour and gristmill products. The value of the yearly output is about $82,500,000. The provinces having the largest number of establishments are Ontario and Quebec. Winnipeg, in Manitoba, is one of the leading flour-manufacturing cities of the world; Toronto, Montreal and Vancouver are other important centers. On the outbreak of the War of the Nations in 1914 Canada sent 1,000,000 barrels of flour to Great Britain, a gift that was gratefully received by the British government. The Dominion export trade amounts to nearly 5,000,000 barrels a year.

Budapest, Hungary, is the leading European city engaged in the production of flour. The

important flour-producing countries, in addition to Canada and the United States, are Argentina, Australia, Austria-Hungary, Belgium, British India, Bulgaria, Germany, the Netherlands, Rumania and Russia, but some of these fall far below the United States. B.M.W.

Related Subjects. The reader is referred to the following articles in these volumes:

Bran	Macaroni
Bread	Rye
Corn	Starch
Food	Wheat
Gluten	Yeast

FLOWERS, in the popular sense, are the blooms or blossoms of trees and plants. They are wonderful creations which spring from the dull, dark earth, and appeal with their beauty and sweetness, not only to the eyes and hearts of human beings, but also to birds, butterflies and insects. They are those wonders of nature which, from the time man learned to express his thoughts in written language, have inspired artists and poets. Like human children, these children of Mother Nature bring with them happiness, or peace, or comfort. Mary Howitt says, in her *Use of Flowers:*

God might have made the earth bring forth
Enough for great and small,
The oak tree, and the cedar tree,
Without a flower at all.

Then wherefore, wherefore were they made
All dyed with rainbow light,
All fashioned with supremest grace,
Upspringing day and night?

Our outward life requires them not,
Then wherefore had they birth?
To minister delight to man,
To beautify the earth;

To whisper hope—to comfort man
Whene'er his faith is dim;
For whoso careth for the flowers
Will care much more for Him!

Henry Ward Beecher, in his *Discourse of Flowers,* tells us that "Flowers have an expression of countenance as have men or animals. Some seem to smile; some have a sad expression; some are pensive and diffident; others again are plain, honest and upright."

In botany, the word *flower* means a branch or shoot which is highly modified for the purpose of insuring the increase of the plant through the production of seed.

Flower Structure. In a typical flower there are four circles, or sections, each specially divided into other parts.

Calyx. The first or outermost circle is the calyx. Its form, that of a cup, suggested the name, which is derived from the Latin *calix,* meaning *cup.* The calyx is leaflike in structure, nearly always green, but sometimes it is the most brightly-colored part of the blossom. Its duty is to protect the more delicate parts within. The separate divisions, or leaves, of the calyx are called sepals (see illustration).

Corolla. The next circle, within the calyx, is the corolla. The word is Latin, and means *little crown.* The corolla of a flower is usually brightly-colored; it is what people usually call the blossom, and to the child it is the whole flower; it is that part of the flower which invites the insects and birds. It also protects still further the very heart of the flower.

Petals. Each leaf of the corolla is called a petal. When the delicate beauty of many corolla-leaves is regarded, it is easy to believe with M. M. Ballou, who writes:

For mine is the old belief,
That midst your sweets and midst your bloom,
There's a soul in every leaf.

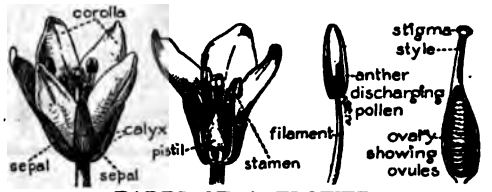
Stamens. Within the corolla is a circle of slender stalks with little knobs at the top. These are called stamens, which is the Latin for *thread,* and they are the male organs of the flower. Their duty is the production of *pollen,* which is described below.

Filament. The threadlike stamen-stem is called the filament. Its only duty is to support the knob at the top.

Anther. The knob at the top of the filament of a stamen is called the *anther.* It usually consists of two lobes, or cells, each with a lengthwise slit. Within these cells is a powderlike substance, generally of a yellow color, which is discharged at a special time in the life of a flower. The word is from the Greek, meaning *flowery,* or *blooming.*

Pollen. The powdery substance contained in the anthers is called *pollen,* a Latin word meaning *fine dust.* Pollen is the fertilizing matter of flowers.

Pollen grains vary greatly in size, shape and markings. Some are dry and very tiny, and sometimes fitted with little wings, so that they are easily carried by the wind. Others are covered with a sticky substance, so that



PARTS OF A FLOWER

they become attached to visiting insects. Some are round; others are angular. Some are smooth; others are rough. The work they do is described under the title POLLEN AND POLLINATION.

Pistil. The innermost organs are called *pistils.* They are so called from their resemblance to the pestle of a mortar, having a small knob at the top and an enlarged portion at the bottom. They are the female, or seed-bearing, organs of the flower.

Ovary and Ovules. The pistils have an enlarged hollow chamber at their base, called the *ovary.* Within that chamber are the undeveloped seeds, and these little eggs are called *ovules.*

Style. Up from the ovary extends the long, tapering portion of the pistil, called the *style,* from the Greek word for *pillar.* It supports a knob called the *stigma.* When pollination has taken place in a flower, pollen tubes grow down through the style to meet and fertilize the ovules in the ovary below.

Stigma. At the tip of the style is the *stigma,* an expanded knoblike or grooved surface. The word *stigma* is from a Greek word meaning *mark,* or *blemish.* When ripe, the stigma secretes a sticky fluid or grows a coating of hairs, by means of which pollen-grains are held to it. These pollen-grains grow down through the style and fertilize the ovules, as explained above. In this way life is brought to a sleeping cell, and a seed is made from which future generations of plants will spring.

In some plants there is no style or stalk, and then the stigma rests directly on the ovary.

Variation in Flowers. Very few flowers are altogether true to the type described above. Often not all of the four circles are present. Either the calyx, or the corolla, or both, may be lacking. Only stamens may be found in one flower, while the pistils may be in another flower on the same plant. Or all the flowers on one plant may have stamens only; that is, they will be the male or pollen-bearing flowers, while those of another plant of the same species may have the pistils only, and be the female, or seed-bearing, flowers. Some flowers have all the petals the same size and same shape; others have a few petals large and the rest very tiny. Some flowers open during the day; others, and those are usually white or of pale colors, open at night.

Every strange form or habit of a flower, however, exists for a definite purpose in the life of that plant. The one big necessary thing in that life is the transferring of pollen from stamen to pistil. It has been proved that those plants grow strongest and best which are from seeds which have had new characteristics brought to them through the pollen from a different flower on the same plant, or from an entirely different plant (see CROSS-FERTILIZATION). So the brilliant colors, the varied and wonderful shapes, the markings, the fragrance and the honey-bearing sacks are all methods of attracting insects or birds to help in Mother Nature's wonderful work of pollination (see BOTANY, subhead *Why Plants Need Insects*). One of the special structures of flowers and pollen-bundles to insure the reproduction of a plant is interestingly shown in the life history of the orchid.

Then, when seeds have finally been made, comes the matter of putting those fertilized ovules into the ground, in new surroundings, to start another generation of plants. That story is so long and interesting, it is told farther on in these volumes under the heading SEEDS.

The Yesterday and To-day of Flowers. At one time all flowers were wild, and many of the beautiful varieties and forms which are seen to-day did not exist. Some time in the far-away past some savage woman, perhaps, carried from a woodland tangle to the door of her cave a gaily blossoming plant which pleased her eye. There it was carefully nourished and lovingly helped in its struggle for existence, and the culture of flowers began. Then, down through the centuries simple garden plots grew into stately, well-kept flower-beds on large estates, for the love of flowers has passed down from generation to generation. From the busy housewife, the care of flowers

FLOWERS, FROM NORTH TO SOUTH

ransferred to special workers. They, in urn, having time and the desire to experi- and to study, found it possible to create orms of life by aiding Mother Nature in ork and hastening her processes. The e of raising plants and producing new nproved forms of life has become a life with many men (see BURBANK, LUTHER).

raising of plants for commercial pur- has grown into an important industry. ts, everywhere, supply flowers to those eople who have neither the time, the nor the means to grow them; and to

DREN SHOULD DELIGHT IN FLOWER CULTURE

who wish to pay the price, they furnish lants, or flowers out of season, which be carefully grown under glass. There er 7,400 florists' establishments in the States, each producing at least $250 of flowers a year. The entire output year is valued at about $35,000,000; al- 15,000,000 square feet of land are under In all the larger Canadian cities, espe- n the eastern provinces, there are estab- nts of a similar character.

of Flowers. Flowers are not only used ke home sites more beautiful, but they d for interior decoration, as well. They God's beautiful out-of-doors within; they comfort and kind thoughts; they have uage for the bride in her wedding gar- and they speak to those bereft of loved

ones. As Percival tells us, in *The Language of Flowers:*

In Eastern lands they talk in flowers,
And they tell in a garland their loves and cares;
Each blossom that blooms in their garden bowers,
On its leaves a mystic language bears.

Flowers in Medicine. As the roots, leaves and seeds of many plants are used in medicine, so, too, are a number of flowers used to bring practical relief to the suffering. The flowers of the American linden, or basswood, are collected in May or June, carefully dried in the shade and then sold for about thirty-five cents a pound. A drink brewed from those flowers is used as a remedy for headaches and indigestion, and for breaking up colds.

The corolla-leaves of flowers of the coarse weed mullein, collected when nearly open and then dried, are used to relieve coughs, catarrh and diarrheal complaints. The wholesale price of mullein flowers is listed at seventy to eighty cents a pound.

Both flowers and fruit of the elder are used medicinally. The flowers, if collected when fully open and then quickly dried, contain properties which make them valuable. They are used to produce perspiration and for poultices and ointments in treating rheumatism, sores, burns, etc. Elder flowers bring about eighteen to twenty cents a pound.

Flowers in Perfumes. All plants produce within themselves some special kind of oil which gives forth an odor either pleasing or unpleasant. The use of such oils is to provide the blossoms with those fragrances or scents which attract the creatures which are necessary to the plant's existence (see BOTANY, subhead *Interesting and Curious Plants*). Joubert, in *Thoughts,* expresses the beautiful sentiment that "The odors of flowers are their souls." To preserve those "souls" a little longer, and to bring to us those fragrances which we love when we cannot have the flowers themselves, the great industry of preparing perfumery from flowers has been established.

When we look into the faces of flowers and think of their life histories from seed to seed—lives affected by heredity and environment just as are our own lives—we can understand that sentence from Christina G. Rossetti's *Consider the Lilies of the Field:*

Flowers preach to us if we will hear.

Suggestions for a Flower Garden. The pleasure and satisfaction derived from the planting and rearing of beautiful, fragrant flowers more than offset the sacrifice of time and

Planting-Table for Flowers

Variety	Amount of Seed for 10 Feet of Row	Depth to Plant Seed, Inches	Distance Apart of Rows, Inches	Distance Apart of Plants in Row, Inches	Time to Plant		Height of Plant when Well Grown Inches	Color of Flowers
					Indoors	In Open Ground		
Ageratum	1 pkg.	¼ to ½	12	6	March	May	6 to 9	Blue
Alyssum	1 pkg.	¼ to ½	12	6		May	3 to 6	White
Aster	1 pkg.	½ to ¾	12	9 to 12	March	May	12 to 36	White
Balsam	1 pkg.	½ to ¾	24	24	April	May	24 to 30	Pink
Candytuft	1 pkg.	¼ to ½	12	4 to 6	April	May	6 to 10	White
Cockscomb, low	1 pkg.	¼ to ½	18	12	April	May	12 to 18	Red
Cockscomb, tall	1 pkg.	¼ to ½	24	24	April	May	36	Red
Larkspur, annual	1 pkg.	¼ to ½	12	12	March	May	12 to 18	Blue
Marigold	1 pkg.	¼ to ½	12	6	April	May	6 to 24	Yellow
Mignonette	1 pkg.	¼ to ½	12	12	March	May	12 to 18	Greenish yellow
Nasturtium	1 pkg.	½ to ¾	12	12		May	9 to 12	Red, orange
Pansy	1 pkg.	¼ to ½	12	6	March	April	4	Various
Phlox	1 pkg.	¼ to ½	18	12	March	May	12	Red
Salvia	1 pkg.	¼ to ½	24	18	March	May	24 to 36	Scarlet
Snapdragon	1 pkg.	¼ to ½	12	12	March	May	12 to 36	Yellow
Stock	1 pkg.	¼ to ½	18	12	March	May	12 to 18	Scarlet
Sweet William	1 pkg.	¼ to ½	12	6	March	June	18 to 24	Pink
Verbena	1 pkg.	¼ to ½	18	18	March	May	6 to 8	Blue
Zinnia	1 pkg.	¼ to ½	12	12	April	May	12 to 24	Red

energy necessary for keeping up a garden. School yards, especially, should be made attractive by flower beds. A few general suggestions, applicable for home or school gardening, are here given, including a planting table. It is a good idea to plan the garden before beginning the actual work. Arrange to have the tall plants form a background for those which grow lower; attractive effects may be secured by a careful arrangement of color schemes (refer to table above). See, also, the article Gardening.

The plot selected should be accurately staked out, and should be fertilized with a coating of well-rotted manure. Turn the manure under the soil with a fork or spade, and just before planting give the ground a thorough raking. The plants must be watered when there is a scarcity of rain, and the garden must be kept free from weeds. Good cultivation is essential. This means hoeing the surface of the ground and then dragging a rake lightly over it, so there will be at all times a fine, light layer of soil on the top.

The time of planting, the depth to sow the seeds, and distance between plants and rows are shown in the accompanying table, which applies to the latitude of New York state. Allow ten days later or earlier for every 100 miles north or south of that state. Indoor planting refers to seeds started in the house and transplanted later.

Artificial Flowers

Flowers made by hand are of a great variety of materials, usually in imitation of natural flowers, and are used for scientific as well as for decorative purposes. A collection of glass flowers at Harvard University represents the flora of the United States. Flowers of wax in collections in museums of natural history are strikingly lifelike. The use of artificial flowers for decoration and ornament has resulted in the establishment of an important industry in various countries. At present France and America are the chief centers for the manufacture of flowers for house and table decoration and for adornment of women's apparel. The output from the United States establishments alone is valued at over $9,000,000 yearly.

Artificial flowers have been made since centuries before the Christian Era, and by people of all nations. Although silks, linen, cotton, gauze, satin, velvet, paper, ribbon and kid are the materials now most widely used, the ancient Egyptians used stained horn shavings, and the Romans used gold and silver. The Chinese use rice-paper, the Japanese the pith of bamboo, and in Italy cocoons of the silkworm are dyed and made into flowers. South American Indians utilize feathers for this purpose, and savages of different countries make lovely sprays of flowers from dainty shells.

To make flowers of glass and of wax for scientific purposes requires skill and knowledge of plant life, but the production of many of the realistic artificial flowers of cloth which are sold to-day also calls for art and delicacy. Most of the work is done by hand. First, the various fabrics employed are cut into shapes of leaves, petals, etc., but that is often done by machinery. Then veins are impressed in

leaves by means of dies, and petals are given their hollow form. After that the various parts are assembled by hand and built into the form of a flower, from the center outwards. The flower is then mounted on its stem of wire, and finally the stem is wrapped with tissue paper, silk, or a green rubber tubing. If variations in tint are desired, which must be added with a brush, the leaves and petals are passed to the artist directly from the cutter.

Not only are artificial flowers of to-day copies of natural flowers, but manufacturers have placed on the market what are known as *fancy flowers,* inventions to use up waste pieces, and the demand for these is considerable, although they represent no living species. L.B.

State Flowers

In nearly every state of the United States some flower more prominent locally than others or beloved for sentimental reasons has become popularly recognized as the emblem of the state. In most cases the choice has been emphasized by act of legislature or by vote of the school children. The following is a list of those commonly accepted:

Alabama .....Goldenrod
Alaska .....Forget-me-not
Arizona .....Sequoia Cactus
Arkansas .....Apple Blossom
California .....Golden Poppy (Eschscholtzia)
Colorado .....White and Blue Columbine
Connecticut .....Mountain Laurel
Delaware .....Peach Blossom
Florida .....Orange Blossom
Georgia .....Cherokee Rose
Idaho .....Syringa
Illinois .....Violet
Iowa .....Goldenrod
Kansas .....Sunflower
Kentucky .....Goldenrod
Louisiana .....Magnolia
Maine .....Pine Cone and Tassel
Maryland .....Black-Eyed Susan
Michigan .....Apple Blossom
Minnesota .....Moccasin Flower
Mississippi .....Magnolia
Missouri .....Goldenrod
Montana .....Bitterroot
Nebraska .....Goldenrod
Nevada .....Sagebrush
New Jersey .....Sugar Maple (tree)
New Mexico.....Cactus
New York .....Rose
North Dakota....Goldenrod
Ohio .....Scarlet Carnation
Oklahoma .....Mistletoe
Oregon .....Oregon Grape
Rhode Island....Violet
South Dakota....Anemone
Texas .....Blue Bonnet
Utah .....Sego Lily
Vermont .....Red Clover
Washington .....Rhododendron
West Virginia....Rhododendron
Wisconsin .....Violet
Wyoming .....Gentian

National Flowers

Since earliest times flowers have been adopted as national emblems. As with individuals, so with the people of a nation; some flower has stood in the memory for years, through association with important events, or with religious ceremonies. So what more appropriate to adopt as that nation's symbol than one of nature's wonders?

One of the oldest of national flowers is that of Egypt, a beautiful species of water lily called the lotus. That flower was always connected in the minds of the Egyptians with their gods and with wisdom. India, too, holds the lotus flower sacred, from the belief that Brahma, the Supreme Being in Hindu religion, was born in its bosom, and it became that nation's flower symbol also.

Persia is a land of beautiful roses, and each year a feast of roses is held as long as those flowers bloom; so the rose is the emblem of Persia. The national emblem of Japan is the chrysanthemum, or golden flower, and the country itself is popularly called the "Land of Chrysanthemums." China has chosen the narcissus as its national emblem.

Greece is a land where flowers have always held a position of importance, and there the violet has been chosen as the national emblem. Italy has chosen the white lily, Spain the pomegranate, France the *fleur-de-lis* and Switzerland the rare edelweiss.

The emblem of England, the rose, brings to mind the War of the Roses, at the close of which the Tudor rose was chosen as the nation's symbol. The shamrock holds its place in Irish hearts because Saint Patrick used it to illustrate one of his sermons. A moat filled with thistles saved a fortress in Scotland from Danish invasion in the reign of Malcolm II, and the thistle was adopted as the national emblem, in gratitude for the escape. So on the coat-of-arms of Great Britain, just below the shield, are engraved the rose, the thistle and the shamrock.

The story behind the adoption of the cornflower, or *Kaiserblume,* as the national emblem of Germany, is a very pretty one. When Napoleon's army held Berlin, Louise, the queen-mother of Emperor William I, taking refuge outside the city, comforted her children by weaving for them garlands of cornflowers from the wayside. After that the cornflower was the favorite of William and the German people.

While marching to battle against an English army in A. D. 640, the men of a Welsh army plucked leeks to place in their caps to distinguish themselves from the enemy. They were victorious that day, and the leek was chosen as the emblem of Wales.

Mexico has chosen the nopal cactus, or prickly pear, as its emblem, and Canada, the leaf of the sugar maple, remarkable for its beautiful coloring in autumn. By popular vote, the widely-distributed goldenrod has been adopted as the emblem of the United States, as not yet has tradition made any flower especially significant.

The following is a list of national flower emblems, the countries being arranged in alphabetical order:

Canada	Maple Leaf
China	Narcissus
Egypt	Lotus
England	Rose
France	Fleur-de-lis
Germany	Cornflower
Greece	Violet
India	Lotus
Ireland	Shamrock
Italy	White Lily
Japan	Chrysanthemum
Mexico	Nopal Cactus, or Prickly Pear
Persia	Rose
Scotland	Thistle
Spain	Pomegranate
Switzerland	Edelweiss
United States	Goldenrod
Wales	Leek

Language of Flowers

Bishop Coxe said, in his *The Singing of Birds,*

> Flowers are words
> Which even a babe may understand.

Throughout the years, and in all nations, certain flowers have always signified a certain sentiment, owing to individual properties or special characteristics, as the amaranth for immortality, because it lasts so long; the poppy for forgetfulness, because stupefying opium is made from its seeds; the brier for insult, because of its thorns.

Poets and peoples of all nations have attributed meanings to many flowers, and so originated a custom of expressing one's thoughts and feelings by means of flowers.

Among the Greeks and Romans the language of flowers was in vogue, and all events of interest were represented by flowers or leaves. The olive was the token of peace; the bay was the poet's crown; the myrtle was the crown for beauty, and the oak was the patriot's crown. A laurel wreath marked success and high achievement. Tender messages were conveyed by lovers through beautiful flowers, and to some extent that custom still exists. A single red rose means "I love you"; the moss-rose bud is a confession of love; a white rose signifies happy love.

The following is a list of flowers whose meanings are well established through the poetry and prose of nations:

Amaranth	Immortality
Anemone	Anticipation, Frailty
Apple Blossom	Admiration
Aspen Leaf	Fear
Brier	Insult
Buttercup	Wealth
Camellia	Illness
Calla	Magnificent beauty, Pride
Candytuft	Indifference
Cornflower	Heaven
Cowslip	Youthful beauty
Cypress	Death
Daffodil	Unrequited love
Daisy	Simplicity
Dandelion	Coquetry
Evergreen	Hope
Everlastings	Undying affection
Fern	Forsaken
Five-leafed Clover	Bad luck
Forget-me-not	True love
Four-leafed Clover	Good luck
Foxglove	Insincerity
Gentian	Virgin pride
Geranium	Deceit
Goldenrod	Encouragement
Heather	Loneliness
Heliotrope	Devotion
Hepatica	Anger
Honeysuckle	Fidelity
Hyacinth	Sorrow
Ivy	Trustfulness
Laurel	Fame
Lilac	Fastidiousness
Lily	Majesty, Purity
Lotus	Forgetfulness
Marigold	Contempt
Moss or a dry twig	Old age
Myrtle	Wedded bliss
Narcissus	Vanity
Oak Leaf	Power

Orange Blossom	Marriage
Oxalis	Pangs of regret
Palm Leaf	Conquest
Pansy	Thoughts
Poppy	Oblivion
Rose	Love
Rosemary	Remembrance
Rue	Repentance
Scarlet Geranium	A kiss
Snowdrop	A friend in need
Sting Nettle	Rudeness
Sweet William	Gallantry
Tuberose	Bereavement
Tulip	Boldness
Violet	Modesty
Yellow Rose	Jealousy

Consult Stack's *Wild Flowers That Every Child Should Know;* Morley's *Flowers and Their Friends;* Gibson's *Blossom Host and Insect Guests;* Maeterlinck's *The Intelligence of the Flowers;* Skinner's *Myths and Legends of Flowers, Trees, Fruits and Plants.*

Related Subjects. The following list includes not only the flowers given separate treatment in these volumes, but a number of more general articles which have to do with certain phases of the subject:

Canna	Everlasting Flower
Cardinal Flower	Fleur-de-lis
Carnation	Forget-me-not
Chrysanthemum	Four o'clock
Clematis	Foxglove
Columbine	Fuchsia
Convolvulus	Gardenia
Cosmos	Gentian
Cowslip	Geranium
Crocus	Gladiolus
Cyclamen	Gloxinia
Daffodil	Goldenrod
Dahlia	Harebell
Daisy	Heliotrope
Dandelion	Hepatica
Day Lily	Hibiscus
Dog's-tooth Violet	Hollyhock
Dutchman's Breeches	Honeysuckle
Easter Lily	Hyacinth
Edelweiss	Hydrangea
Adonis	Immortelle
Agrimony	Iris
Amaranth	Jasmine
American Beauty	Jonquil
Anemone	Kaiserblume
Arbutus	Lady's Slipper
Asphodel	Larkspur
Aster	Lilac
Azalea	Lily
Bachelor's Button	Lily of the Valley
Begonia	Lobelia
Bignonia	Lotus
Bitterroot	Marigold
Black-eyed Susan	May Apple
Bleeding Heart	Mignonette
Bluebell	Moccasin Flower
Bridal Wreath	Moonflower
Buttercup	Morning-glory
Calla	Narcissus
Camellia	Nasturtium
Campanula	Oleander
Candytuft	Orchid
Oxeye Daisy	Sweet Alyssum
Pansy	Sweet Pea
Passion Flower	Sweet William
Peony	Tiger Lily
Petunia	Trillium
Phlox	Trumpet Flower
Pink	Tuberose
Poinsettia	Tulip
Poppy	Verbena
Primrose	Violet
Rhododendron	Wall Flower
Rose	Water Lily
Sunflower	Zinnia

GENERAL

Amaryllis Family	Herbarium
Botany	Herbs
Bud	Inflorescence
Bulb	Leguminous Plants
Catkin	Perfume
Composite Family	Plant
Cross-Fertilization	Pollen and Pollination
Exotic	Rose Family
Flora	Seeds
Greenhouse	Spurge Family

FLOYD, *floid,* JOHN BUCHANAN (1807-1863), an American statesman and Confederate soldier in the War of Secession. He was graduated from South Carolina College in 1826, practiced law in Virginia and in Arkansas, and was governor of Virginia from 1846 to 1852. In March, 1857, he became Secretary of War in President Buchanan's Cabinet, but his lack of administrative ability soon became apparent. In December, 1860, Floyd was discovered honoring heavy drafts made by government contractors in anticipation of future earnings, and the President requested his resignation.

In February, 1862, he became commander of the Confederate forces at Fort Donelson, and on the night of February 18 he fled, with his second in command, General Pillow, leaving General Simon B. Buckner to surrender to General Grant. Two weeks later he was relieved of his command by President Davis, and died at Abingdon, Va., during the next year.

FLUORESCENCE, *floo o res' ence,* a property possessed by certain substances by virtue of which they send back to the eye rays of light of a different color from that of the rays falling upon them. The name was taken from the mineral *fluor spar,* many violet and green varieties of which exhibit this property in a marked degree. A fluorescent substance absorbs a part of the light which falls upon it, modifies it to a great extent, and then radiates it again; the modification consists in increasing the wave-length of the light which strikes the body.

This phenomenon was discovered by Sir David Brewster in 1833, in the course of his

experiments with light. He admitted a beam of sunlight through a lens into a solution of chlorophyll, which is the green coloring matter of plants, and discovered that the path of the rays within the solution was marked by a bright red light, though blue, yellow and orange were absorbed. Similarly, he found if a beam of sunlight falls upon a solution of sulphate of quinine the portions of the surface where the light strikes show a bright blue color. Canary glass, which is glass colored with oxide of uranium, also possesses this property, and when illuminated its surface exhibits a beautiful yellowish-green. In each case the fluorescent light corresponds to a wave-length longer than that of the colors absorbed by the substance. Nearly all kinds of paraffin oil and solutions made from the bark of the horse chestnut are highly fluorescent.

When the source of illumination is removed, most fluorescent substances cease to give off light. There are some, however, such as diamonds, calcium tungstate and the sulphides of barium, calcium and strontium, which glow for some time in darkness. Such bodies are called phosphorescent.

Related Subjects. The reader is referred to the following articles in these volumes:

Color	Light
Fluor Spar	Phosphorescence

FLUORINE, *floo'o rin,* an element which enters into the composition of the very abundant mineral known as fluor spar, which is a combination of fluorine with calcium. Small quantities of combined fluorine are also found in bones, in the enamel of the teeth and in the blood. Fluorine is never found in a free state in nature, because it is the most active element chemically and enters easily into combination with other elements. Fluorine was isolated for the first time in 1886 by the French chemist Henry Moissan (1852-1907), who decomposed hydrofluoric acid by electricity.

Fluorine belongs to the group known as the halogens (which see). It is a greenish-yellow gas, with a sharp odor, and it is just a little heavier than air. It can be liquefied when subjected to high pressure and low temperature. Fluorine does not burn in air, which means that it does not combine with oxygen, but most metals burn in it, forming *fluorides.* [redacted] phosphorus and carbon take [redacted]el containing fluorine. [redacted]y fluorine at ordinary [redacted]t of the great attrac-[redacted], with which it forms hydrofluoric acid (which see). The chemical symbol for fluorine is F. See CHEMISTRY.

FLUOR SPAR, *floo'or spahr,* the mineral used for etching glass. It is a compound of oxygen, fluorine and calcium, and occurs in beautiful cubelike crystals, which may be blue, yellow, green or red, but the blue are the most common.

To write your name on glass with fluor spar, place some powdered fluor spar and sulphuric acid in a lead dish. Coat a piece of glass with wax, then write your name in the wax with some sharp-pointed instrument, such as a brad-awl. Place the glass wax side down on the dish and slightly warm the mixture. In a few minutes the acid set free will etch the name in the glass. See FLUORESCENCE.

FLUTE, in music, a term applied to a wind instrument, usually made of wood and consisting of a pipe pierced with holes. In the same class are the fife, flageolet and piccolo, all described in these volumes. Sound is pro-

FLUTE

duced by a current of air entering the tube. The ancient Hebrew and Greek forms were held away from the player, who blew through a mouthpiece at the end. The modern flute is played by blowing through a mouthpiece in the side. The tube is about twenty-seven inches long, and may be made of boxwood, ivory, ebony or silver, with mountings to suit individual taste. In a modern orchestra the flutes have an important and most effective part. Usually there are two, and when, in loud and strong passages, a third is required, it is generally the piccolo that is used. This is a small flute, with a high, shrill tone, a little unpleasant to some people.

FLUX, *fluks,* a word derived from the Latin *fluere,* meaning *to flow,* and now applied scientifically to any substance added to ore before melting, as an aid in separating impurities from the metal. In iron smelting, the flux generally used is limestone, which readily combines with the undesirable properties in the ore and forms a slag which may be easily removed from the molten iron. Fluxes consisting of mixtures of borax, soda and potash are used to separate base metals from gold and silver. In assaying silver, litharge and red lead are used, as they quickly dissolve metallic oxides. The proportion of flux required can only be decided by experiment, as ores vary considerably.

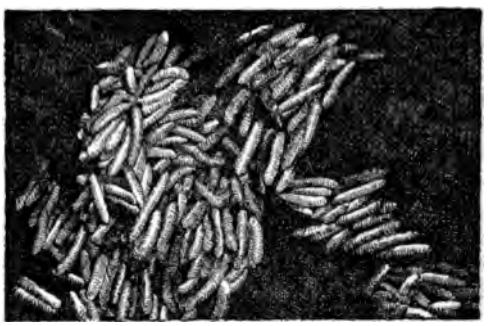
FLY. "A fly," wrote a small boy who had had a lesson in school on the harm the little pest can do, "is more dangerous than a lion, but I would rather have a fly bite me than a lion." Not many years ago flies were looked upon as a necessary nuisance; they were troublesome, but they were not dangerous, people thought, and there was no possible way of getting rid of them. A half-century ago it was common at mealtime during the summer months to have a servant or one of the children of the family stationed near the table with a leafy branch, wherewith to wave away the flies which were thick in the dining-room. A little later nettings were introduced, and then came wire screens, to keep out as many as possible; but to-day such measures are looked upon as all too passive, because the deadly nature of the insect is understood, and regular crusades are instituted against the fly.

But why? What can this little insect do that makes it as "dangerous as a lion," and has caused "Swat the fly" to become a slogan? Before discussing this question it is necessary to learn something about the insect.

What a Fly Is. The name *fly* is applied to many different kinds of insects; in fact, more than 40,000 species are known to-day, but they all have certain traits in common. The most noticeable of several resemblances is the fact that they have but two wings; the scientific name for flies is *Diptera*, which means *two-winged*. No other known insect has two wings except one little scale-insect. The wings of flies are always transparent, never folded as are the wings of grasshoppers, and they have prominent lengthwise veins. Instead of hind wings most flies have two small, rod-like organs which probably help the insect to balance and steer itself in flight. The head of a fly is usually small; by far the larger part of it is made up of two wonderful eyes, which are often composed of thousands of facets which enable their owner to see in almost any direction. A few species are provided with sucking mouth-parts, but fortunately the common house fly is not thus equipped.

The Commonest Fly. Of the true flies, a number of groups are very well known, as the *gnats, blow flies, midges* and *mosquitoes;* and the name is often applied to certain insects to which it does not really belong, as the *dragon fly* and the *May fly*. But there is one true fly which is so common all about the haunts of man that it has received the name of *domestic fly*, or *house fly*, and it is this little creature which is meant when the term *fly* is used without modification.

Life History. There are some very interesting things about the house fly. Every child has watched with wonder its progress across the ceiling, to which it is held by the sucker-like hairs on its feet; but nothing about it is

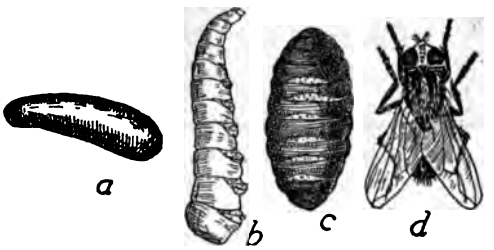


EGGS OF A FLY
Greatly enlarged.

more remarkable than the amazing rapidity with which it breeds. If there were alive in the world at the beginning of April but one fly, and that an egg-laying female, there might be six months later, if all the eggs laid came to maturity, no fewer than 131,220,000,000,000,000,000 flies—over 131 quintillions of descendants of that one first fly! What wonder is it that a neighborhood which seemed free from flies may in a week or two be swarming with them!

The female lays her eggs in any warm, damp, decaying matter, whether it be the manure of a stable, the filth of a pig's pen or the fermenting garbage; and there the little white maggots are hatched out. Soon these change

into *pupae* (plural of *pupa*, the intermediate state), and in from eight to fourteen days emerge as mature flies. Led by its strong sense of smell, the young fly hastens from its



DEVELOPMENT OF A FLY
(*a*) Egg; (*b*) larva; (*c*) pupa; (*d*) mature insect.

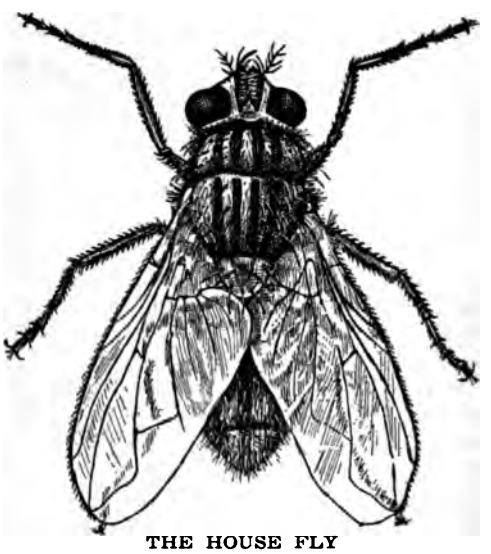
filthy hatching place to the nearest food-supply spot—perhaps an imperfectly screened kitchen or the baby's milk, where it begins to be indeed a deadly enemy.

Harm Done by Flies. Occasionally some person objects that the fly is receiving more than its share of censure, claiming that a little stingless insect cannot be one of the most dangerous things in the world; but doctors and scientists are ready with facts to prove the contrary. It is no longer a theory but a well-established fact that flies cause many of the cases of typhoid; that "summer complaint" might well be called "fly complaint," so clearly is it spread by flies; that tuberculosis and all filth diseases are carried by it; that domestic animals owe many of their diseases to its agency—in fact, that flies cost in Canada and the United States hundreds of millions of dollars and scores of thousands of lives every year.

How they accomplish all this is very evident, since their hairy legs are peculiarly well fitted for carrying germs and filth particles from their favorite breeding-haunts to food often left exposed for them to walk upon. More than 6,000,000 bacteria, it has been estimated, can be carried by one fly on its body as it flies from the manure pile or the spittoon or the sick room to the baby's lips or to the sugar bowl. It is not chance that the fly season coincides with the season of dangerous intestinal diseases and, very largely, with the typhoid season; it is a clear case of cause and effect.

Facing the Fly Problem. The average person feels helpless and hopeless in facing the question of what is to be done about it. "There always have been flies, therefore there will be flies," is his opinion, despite any little efforts on his part. Serious, scientific men have faced the problem in a sober-minded, scientific manner, and have found ways and means which, if generally adopted, would do much toward ridding the world of this pest. In agricultural communities, such favorable breeding-grounds as manure heaps and open swill barrels can be replaced by covered manure bins and screened-top barrels, and the flies be kept down; cities and villages, however, may, with proper care, be flyless.

Some of the remedies are easy to apply and have been employed for many years. Windows and doors may be screened and "sticky fly-paper" may be placed to catch those which do slip in; but this is not beginning at the source. First of all, the fight must be carried out-of-doors. "Why not," asked a thirteen-year-old boy, who had become interested in the extermination of flies, "put all the flies in jail and



THE HOUSE FLY
Greatly enlarged.

let ourselves out?" The annual cost of screening windows and doors, estimated for the United States and Canada at $15,000,000, would, if properly expended, make screens unnecessary.

Preventive Methods. The first step in a definite campaign is to kill the winter fly—the occasional specimen that survives in a sheltered place and in the spring crawls out to bask and gain strength in the sunshine. Kill it without pity—it may be that thereby the world is being rid of countless millions of summer flies. Until these winter flies have obtained abundant food they cannot lay eggs, and as they are extremely hungry they are easier to

OUTLINE AND QUESTIONS ON THE FLY

Outline

I. Parts of the Fly

(1) Wings
  (a) Only insect except one which has two wings
  (b) Distinguishing marks of wings
    1. Transparent
    2. Not folded
    3. Lengthwise veins
(2) Rodlike "steering" organs
(3) Head
  (a) Large compound eyes
  (b) Mouth parts

II. The House Fly

(1) One of 40,000 species
(2) Rapid breeding
(3) Life history
  (a) Eggs laid in warm, damp place
  (b) The maggots
  (c) Pupae
  (d) Full-grown flies
(4) Danger from flies
  (a) Filthy breeding places
  (b) Diseases carried
    1. "Summer complaint"
    2. Typhoid
    3. Tuberculosis
    4. Filth diseases
  (c) Loss in money and lives because of flies

III. Campaign Against Flies

(1) Old, inadequate methods
  (a) "Shooing" the flies
  (b) Screening
(2) The modern crusade
  (a) Prevention
    1. Killing the winter fly
    2. Cleaning up breeding places
    3. Family work and community work
  (b) The active fight
    1. Fly traps near feeding places
    2. Fly traps outside screen doors
    3. Method of making an effective trap

Questions

Why is it possible for a fly to walk across the ceiling without falling?

What is the significance of the question "Why not put all the flies in jail and let ourselves out?"

Why should the opening in a fly trap be at the bottom rather than at the top?

Name two "flies" that are not really flies.

Why is it not possible for agricultural communities to free themselves of flies as completely as can cities or villages?

How old must a fly be before it can lay eggs? What significance has this in the fight against the fly?

What was the ordinary method of dealing with flies in dining-rooms a half-century ago?

What is the first act of a fly on emerging from the pupa stage?

Why is it unwise to spend sympathy on the surviving winter fly?

Is a campaign for the total extermination of flies in a community practicable?

Give two slogans of the anti-fly crusade.

Why is it possible for a neighborhood to be practically free from flies, and two weeks later to be swarming with them?

What ailment, especially dangerous to children, might well be called "fly complaint," and why?

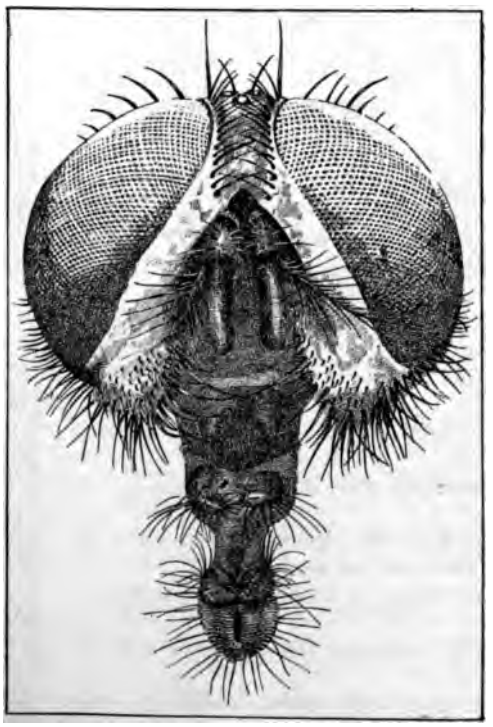
Why cannot one family protect itself against flies without any community effort?

What peculiarity of a fly is its scientific name based on?

What fits this insect particularly for carrying bacteria? How many is it estimated that it can carry at one time?

catch in traps than at almost any other time. If every family in a community would in the early spring days get rid of every fly about the premises there would be no summer campaign, and noonday meals could be eaten on unscreened porches with pleasure and with safety.

Next, breeding-places should be done away with, so far as possible, by providing proper sanitation and by banishing all unnecessary garbage and rubbish. Refuse should be buried or covered with kerosene and burned. Outside slop barrels should be scalded, and in communities where domestic animals are raised care should be taken to have them and the premises kept in a sanitary condition. Much of this work can be done by families in and about their homes; much remains to be done by the public authorities, who can best be urged to a proper conception of their task by enlightened public opinion. Indeed, it may be said that only as community feeling is aroused



ENLARGED HEAD OF A FLY, FRONT VIEW

The two large areas studded with thousands of lenses are compound eyes. There are three simple eyes at the top, in the center; the fly can therefore see in every direction.

[redacted]ally effective work be done, for what [redacted] it do a family to rid its own home [redacted] long as the meat it gets from the market and the butter and milk it gets from the dairies are contaminated by their presence?

The Active Fight. If the work of prevention by means of killing winter flies and destroying breeding-places is begun early enough, it is all-sufficient; but even if a few flies have been allowed to reproduce themselves and their descendants in their turn have been allowed to breed, the fight is not yet hopeless, though it is rendered more difficult.

THE FOOT OF A FLY

(*a*) Lower joints of the foot, one hundred sixty times actual size.
(*b*) The part of (*a*) shown within the dotted area, magnified 1,500 times its actual size. The deadly typhoid bacilli are shown on the tip. The drawing is reproduced from a photograph.

It remains but to catch the flies as soon as possible after they have emerged, before they have reached the egg-laying stage; for it is well to remember at every stage of the campaign that the fly must feed for two weeks before it can lay its first eggs. And these young flies should be caught out-of-doors, before they have had time to carry filth germs into the house. Somewhere near every house, whether it be in the city or in the country, there is a garbage pail—the flies' favorite feeding-ground. Now if, as they swarm about this, they can be coaxed by some especially attractive bait into a trap which stands above the garbage pail, the work is done, in large measure. Then if another trap be placed outside the screen door, and another in the stable window or barnyard, it is not likely that many

flies would feed through the whole two weeks without getting caught. The "catch" may be quickly killed by immersion in boiling water, or by fumigation with sulphur. Humane methods should be employed, even with flies.

Traps may be bought at a reasonable price, or they may be constructed at home still more cheaply. Any box or other receptacle of transparent material, provided with a crack at the bottom and baited with banana peel, sugar and vinegar, meat or other food attractive to flies, will serve the purpose. One point must be borne in mind—the crack at the bottom must not be too wide, or the flies will crawl out after they have fed and then proceed to lay their eggs. The crack should never be more than a quarter of an inch in width and should open *up* toward the bait and not down, as flies show a strong tendency to crawl upward toward the light.

Summary. It may sound at first somewhat visionary—this campaign which has as its aim to "get the last one"—but it has been proved to be sane and practical. Small towns have rid themselves almost completely of the pests; big cities have done such effective work that in the huge public markets no more than half a dozen flies may be found at one time; and neighborhoods have won for themselves relief from the nuisance when other parts of the city have swarmed with flies. These insects do not travel great distances, and a neighborhood campaign will be effective even though the town as a whole does not take up the work. It *can* be done—that much is certain; but it *will* be done only when the people are convinced of the absolute necessity. When a housewife begins to feel that it is a disgrace, a sure sign of untidiness and careless housekeeping to have even one fly about; when the storekeeper or dairyman is made to realize that he is looked upon as a spreader of disease if he does not protect his products; when a community really appreciates the fact that not only unpleasantness but sickness and death result from the presence of flies—then, and not till then, the campaign will be undertaken in earnest. The United States Department of Agriculture has shown an active interest in the problem and has for distribution bulletins which discuss the fly in all its phases, suggesting effective means of combating the danger the fly creates. W.A.E.

Consult Cragin's *Our Insect Friends and Foes*; Comstock's *Insect Life*; Ross's *The Reduction of Domestic Flies.*

FLYCATCHER, a large family of songless, perching birds including about 400 species which are most abundant in the tropics, although thirty species live in the United States. They received their name from the fact that, sitting on a favorable perch, they watch intently for passing insects and dart at them, clicking their bills as they catch their victims. They rarely miss seizing their prey, and as the insects serve as their main food they are forced to migrate in search of them, the phoebe being the only eastern species to winter in the United States. The Acadian flycatcher, wood pewee, crested flycatcher and kingbird belong in this family, but the so-called Old World flycatchers belong to another group.

FLYING DUTCHMAN. In popular legend, a sea captain to whom was meted out a peculiar punishment. He swore, during a violent storm, that he would round the Cape of Good Hope if it took him until the Judgment Day, and in punishment he was forced to sail those seas in a phantom ship forever and ever.

FLYING FISH, an interesting fish which, to escape attacks of other fish, has the power of keeping itself in the air for a short time by means of large fins. In all warm seas flying fish are found, and in the air they look like

FLYING FISH

giant dragon flies. The North Atlantic flying fish is among the best-known species; it was so named because first known in that ocean, but now it is common in all tropical seas. Great schools of these fish greet vessels near the Hawaiian Islands. The *great flying fish,* measuring eighteen inches in length, is found near California, and being a good food fish is caught by the thousands in the vicinity of Santa Barbara. The *sharp-nosed* flying fish is found around Central America.

FLYING MACHINE, man's dream through many ages, made a reality in the present century by the invention of the heavier-than-air device and the development of the balloon from a bubble drifting with the winds to a true airship.

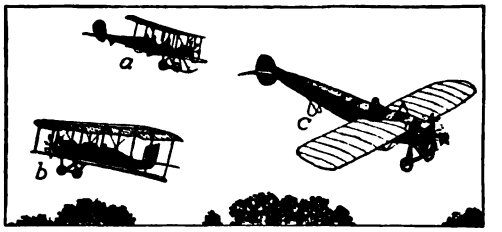
Faith and Unbelief. It is a matter of record that when Wilbur and Orville Wright, the brothers who in 1903 made the first successful flier, announced to their family their intention to build a heavy machine which would fly in the air, their father took immediate steps to discourage so foolish an idea. He wrote to a professor in a great university, outlining the "crazy proposition" and asking him whether he believed it could be done. This professor in his reply declared a man-made flier to be a physical impossibility, and Mr. Wright handed the letter to his sons with the remark, "I told you so."

But the sons had faith in their idea, and they continued their experiments patiently and unceasingly, meeting and overcoming, one by one, the innumerable obstacles which blocked their progress. When at last their machine was tried out in the presence of army officers at Fort Myer, Va., when it soared into the air, obedient to the will of the driver and came lightly to earth again at a spot previously designated, they wired their father, "We told you so."

Why Aeroplanes Fly. The Wright brothers did not discover the principles of flying any more than Watt discovered the power of steam. What they did, like Watt and nearly all other inventors, was to devise a mechanism for utilising principles already known.

The basic idea of a flying machine is simple enough—it flies for the same reason a kite flies. When you close a door, the slanting surface of the latch is met by a metal guard, and though the pressure of the guard against the latch is outward, the latch retreats at right angles into the door. This is because the pressure of the guard acts perpendicularly to the slant of the latch, and (as the article COMPOSITION OF FORCES explains) such a pressure has the same effect as would two forces, one merely pressing the latch against the side of its casing and the other moving it inward. In a kite the pressure of the wind corresponds to the pressure of the metal guard upon the latch; the force of gravity corresponds to the resistance of the spring behind the latch; the kite string corresponds roughly to the casing. If the wind is strong its upward thrust (that is, the upward element of the pressure perpendicular to the kite's surface) will overcome the force of gravity; if not, the boy who flies the kite may increase the pressure by running against the wind.

In an aeroplane there is no restraining string, and the machine can move forward. The effect of so doing is exactly that of the boy running with the kite; it produces air pressure against the slanting under surface of the machine, and if the engines propel the aeroplane fast enough this pressure overcomes the force of gravity and the machine soars into the air.



FLYING MACHINES
(*a*) A British biplane; (*b*) an all-steel battle plane; (*c*) a Brelíot monoplane.

The Pioneers. Not all men of the nineteenth century were like the professor to whom the elder Mr. Wright submitted his question. Those who understood the principle of the kite realized that flying machines could be made if engines could be built capable of driving them at high speed, and if means could be discovered to control their equilibrium and the direction of their flight.

Speed is necessary to an areoplane because in general the pressure of the air beneath it is proportionate to the square of the velocity,

and a machine traveling twenty-five miles an hour has only one-fourth the lifting power of one moving fifty miles an hour. In order to propel their machines at high speed early inventors had to use heavy steam engines and carry heavy loads of fuel and water. If they doubled the size of their wings to double their lifting power, they had to increase the strength, and hence the weight, of their engines. As a result few of their machines ever left the ground.

But even had the pioneer students of flying possessed the light gasoline engines of to-day they could not have succeeded without working out the problems of how to leave the ground and how to preserve the balance of the machine while in flight.

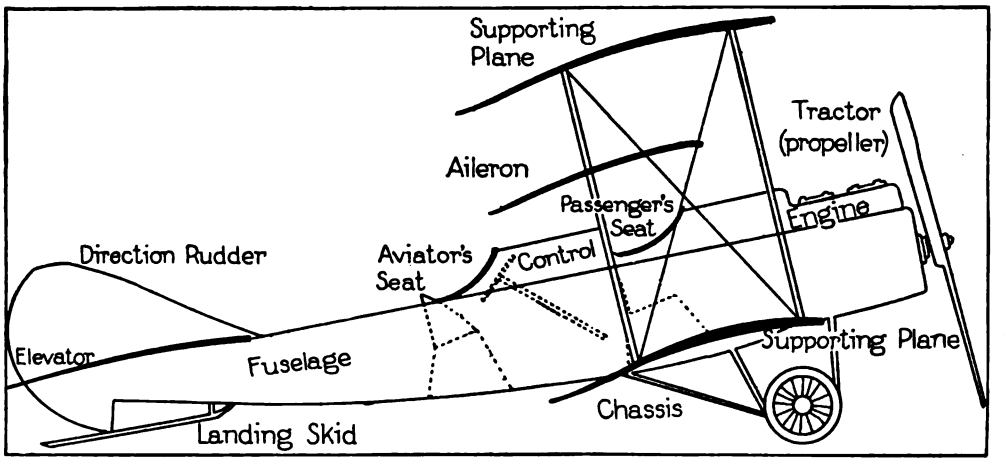


DIAGRAM OF A BIPLANE

To one who sees how easily an aeroplane of the present day mounts into the air after a few seconds run on its rubber tired wheels it seems strange that elaborate starting devices were at first deemed necessary. In 1903, shortly before the Wright brothers' first secret flight, Professor Samuel P. Langley of the Smithsonian Institution completed his "aerodrome," a machine shaped like a dragon fly, for the construction of which the United States government had appropriated $50,000. To launch it he built an inclined track above the Potomac River, and in the two trials of the machine the complicated starting apparatus wrecked it before it could free itself. Glenn Curtiss took the same aerodrome out of the Smithsonian Institution in 1914, placed it on floats so that it could start from the water, added a few braces and gave the engine a new carburetor and radiator, and in spite of an increase of forty per cent in its weight the aerodrome made a number of successful flights. See LANGLEY, SAMUEL PIERPONT; CURTISS, GLENN HAMMOND.

Langley never knew that he had solved the problem of equilibrium during flight, but he was the only man who did solve it before the Wrights. A Frenchman, Clément Ader, flew a hundred fifty feet in 1890 and three hundred feet in 1897, but as he traversed this distance in less than five seconds, his performance ought to be called a leap rather than a flight. Two men who at that time saw that balance was the vital thing to be learned were Lilienthal, a German, and Chanute, an American. Lilienthal began in 1891 to experiment with *gliders*, aeroplanes without engines, and by leaping from the top of a hill in the face of the wind he made more than 2,000 flights, one of 1,200 feet. Lilienthal balanced his machine by his own acrobatic movements, but Chanute, the longest of whose thousand flights was one of 360 feet, believed in adjustable planes.

Man Triumphs. It was in 1900 that Wilbur and Orville Wright began their experiments. So quietly did they work, down among the North Carolina sands, or near their home in Ohio, that four years after their first successful flight a year-book stated that "the mere fact and but little description has ever been recorded." In France, Santos-Dumont in 1906 flew 655 feet and Farman in 1907 covered 2,530 feet, yet the Wrights, who had stopped experiments in 1905 to give attention to their patents, were content with modestly announcing that in that year they had flown twenty-four miles! In their first secret flight, in 1903, they

had traveled 852 feet, just nine days after the last spectacular failure of Langley's aerodrome.

In 1908 the world awoke to the realization that human flying was not, after all, a physical impossibility. The progress that has been made in the short space since then is astounding. It can best be shown by the following lists of record performances:

LONGEST FLIGHT WITHOUT STOP

		Time	Distance
1903	Wilbur Wright	59 sec.	852 feet
1904	Wilbur Wright	5 min. 4 sec.	3 miles
1905	Wilbur Wright	38 min.	24 miles
1908	Wilbur Wright	2 hrs. 20 min. 23 sec.	95 miles
1909	Henri Farman	4 hrs. 17 min. 53 sec.	144 miles
1910	Maurice Tabuteau	7 hrs. 48 min.	365 miles
1911	Alexandre Fourney	11 hrs. 1 min. 29 sec.	(447 miles)
	M. Gobé		460 miles
1912	A. Fourney	13 hrs. 22 min.	(628 miles)
1913	A. Seguin		634 miles
1914	Reinhold Boehm	24 hrs. 12 min.	1,350 miles

LONGEST AEROPLANE JOURNEY

1910	Louis Paulhan, London-Manchester,	185 miles
1911	Calbraith P. Rodgers, New York-Long Beach,	4,029 miles

HEIGHT IN FEET

1908	Wilbur Wright	about 360
1909	Louis Paulhan	1,900-2,000
1910	Arch Hoxsey	11,474
1911	Roland Garros	13,943
1912	Roland Garros	19,032
1913	Georges Legagneux	20,668
1914	Heinrich Oelrichs	26,246

MILES PER HOUR

1909	Leon Delagrange	50
1910	Alfred Leblanc	67
1911	E. Nieuport	83
1912	Jules Vedrines	108
1913	Maurice Prevost	125

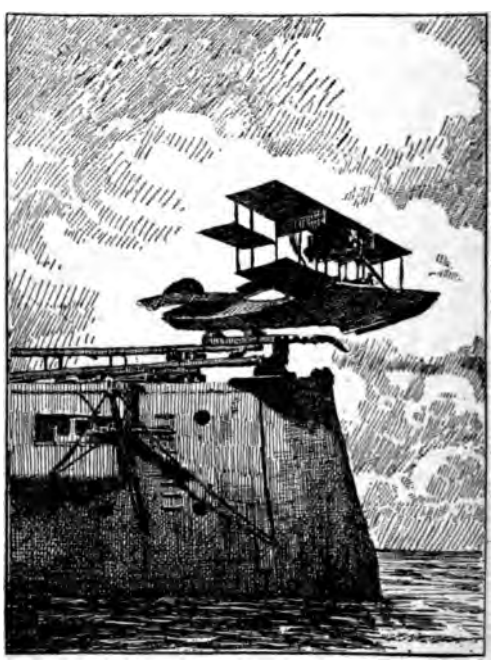
PASSENGERS CARRIED

1908	1	1912	5
1909	2	1913	6
1911	4	1914	20

All of these records were made before the War of the Nations, and without doubt some of them were exceeded in the course of that struggle, in which aeroplanes proved their efficiency both as scouts and as fighters. The progress of aviation was shown in another way in 1913, when the Frenchman Pégoud startled the world by flying upside down and "looping the loop" in the air. This he did in a monoplane, but he soon had many successful imitators in both biplanes and monoplanes.

Aeroplane Types. Until 1916 all the successful flying machines were either *biplanes* or *monoplanes*, but in that year several *triplanes* [redacted]loyed in the War of the Nations, and [redacted]tructed at the Curtiss factory, in [redacted]tes. A *biplane*, as its name indicates, has two parallel planes, which are smooth surfaces of cloth stretched over light, strong frames. A *monoplane* has but one plane, a *triplane*, three. Monoplanes have proved speedier than biplanes and are favorites in Europe, but biplanes are claimed by Americans to be steadier and more reliable.

Wright machines are biplanes. Like those of all aeroplanes since Lilienthal's, their planes are arched from front to back to gain the greatest lifting power with the least resistance to forward progress. The longest edge of each plane is the one which "bites" the air.



BIPLANE ON A BATTLESHIP

Device for launching an airship from the deck of a war vessel.

The distinctive feature of the Wrights' invention is their method of maintaining *lateral stability*, that is, of preventing the machine from tipping to one side or the other. If a gust

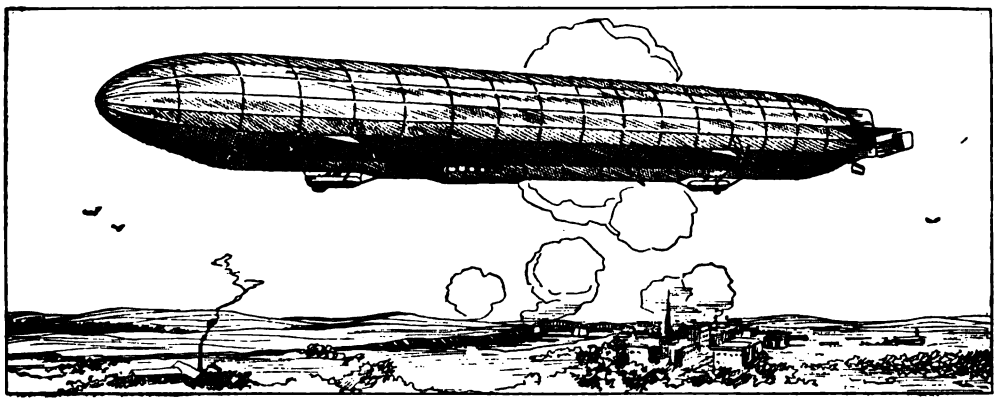
of wind lifts one end of the biplane, they *warp,* or bend, the other end to increase its angle with the ground, and as a result, its lifting power. The machine is turned from right to left, like a boat, by a vertical rudder, and it is made to climb or descend by a horizontal rudder, called the *elevator.* Before 1910 the elevator in Wright machines was in front.

Glenn Curtiss, whose first biplane was built in 1908, invented a substitute for the Wright wing-warping method of maintaining side-to-side balance. His machines are equipped with *ailerons,* or winglets, which are simply horizontal rudders set between the two planes, one at each side.

Monoplanes are the most birdlike of all flying machines. In a biplane the planes usually seem to be the main part, and the elevator and rudders only attachments. In a monoplane, on the other hand, there is a well-defined body, called the *fuselage,* extending from front to back, and the single plane on each side resembles a bird's wing. All monoplanes are tractors; that is, their propellers are in front and pull rather than push. Their stability is secured exactly as is that of biplanes. In recent years tractor biplanes have come into favor, and when built with a solid fuselage, they resemble monoplanes.

Comfort and Safety. There is less reason now to predict that aeroplanes will never come into every-day use than there was at the beginning of the century to assert that man would never fly at all. European aviators early demonstrated that if mounted on wheels flying machines could rise in the air from any reasonably smooth ground without the aid of special launching apparatus, and Curtiss, following in the steps of others, has made flying boats equally serviceable in this respect. The Sperry automatic pilot and similar devices now take from the airman the responsibility of maintaining the stability of his machine in the varying currents of air and leave him little to do but steer. In the larger machines the mechanic may walk about inspecting and adjusting his engines, and the passengers are comfortably seated in a cockpit, or in a cabin.

Dirigible Balloons. Back in the eighteenth century, when men first ascended in balloons, they thought they could row their air-boats. They quickly abandoned this idea, for the very lightness of a balloon in proportion to the surface exposed puts it at the mercy of every current of air. But in 1852 Henri Giffard equipped a cigar-shaped balloon with a very light steam engine and succeeded in attaining a speed of nearly seven miles an hour. Since then dirigible, or direct-able, balloons have steadily increased in speed, strength and dirigibility, and now are able to travel long distances and stem heavy winds.



A 500-FOOT ZEPPELIN IN THE AIR

There are two distinct types of dirigibles, the *rigid* and the *non-rigid.* There is also a *semi-rigid* type, which, as its name indicates, is a compromise. The most famous of all airships, the German *Zeppelins,* are rigid, and their inventor, Count Zeppelin, is the originator of the type. The gas bag of a Zeppelin is stretched over a strong frame of aluminum, and inside of it there are partitions of aluminum which divide it into gas-tight compartments, any one of which may be punctured without causing the airship to fall. The necessities of the War of the Nations brought great improvements and enlargements in the Zeppelins. By the close of 1916 these huge ships were 500 feet in length, and nearly fifty feet

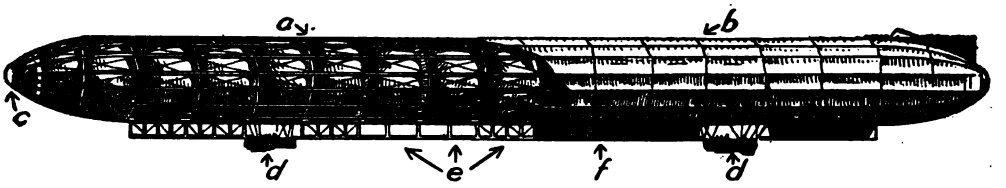


DIAGRAM OF A ZEPPELIN

(*a*) Nine sections showing aluminum girder work under outer fabric cover, and nine of the seventeen chambers, with a hydrogen gas bag in each. (*b*) Outer fabric cover, concealing the other eight gas chambers. (*c*) Solid prow, from which the girders radiate. (*d*) Car, so constructed that it will float on water. (*e*) Opened part of the passageway between the cars; the entire passageway is always covered, as in (*f*).

in diameter. The gas bags of such a model contain 742,000 cubic feet of hydrogen gas. This gas is so much lighter than air that that amount will lift about twenty-one tons of weight into the air. The entire ship and fittings weigh about fifteen tons, therefore the Zeppelins can carry several tons in crew, fuel and supplies.

A non-rigid dirigible has no framework to maintain its shape; if its gas contracts, air is pumped into a number of small internal balloons. The principal advantage claimed for the non-rigid type by its greatest advocate, the German Major Parseval, is that when not inflated it can be folded up and transported from place to place. Before the War of the Nations a French non-rigid, the *Adjutant Vincenot,* held the record for the length of a single voyage, having been thirty-five hours and twenty minutes in the air.

During the War of the Nations a number of combination dirigibles and aeroplanes were successfully flown. They were much smaller than the true dirigibles, which are usually a few hundred feet in length. A.C.

Consult Berriman's *Aviation;* Curtiss and Post's *Curtiss's Aviation Book;* Maxim's *Artificial and Natural Flight.*

Related Subjects. The reader is referred to the following articles in these volumes:

Balloon	Langley, Samuel
Curtiss, Glenn	Pierpont
Hammond	Wright, Orville and Wilbur

FLYING SQUIRREL, a small squirrel whose name suggests power of flight similar to that of the birds. However, it does not possess ability to fly. It has a fold of skin along each side of its body, connected with its legs, enabling it to make long, flying leaps through the air, its flight sometimes extending as far as sixty [illegible] but always in a downward direction. It [illegible]l in its habits, that is, it is abroad [illegible]d it is easily tamed. It so closely resembles in color the decayed tree trunks in which it makes its home that it is almost invisible. It feeds on nuts, leaf buds, birds' eggs and sometimes on young birds. The smaller species are common to North America and Europe. The common flying squirrel found in

FLYING SQUIRRELS

the Eastern United States is six to seven inches long, exclusive of the tail, has extremely soft fur, which is of little commercial value, and soft black eyes. The larger flying squirrel, or *taguan,* is found in Indian and east Indian regions, and is sometimes called the *flying marmot,* or *flying cat.* See SQUIRREL.

FOG, or MIST. When a cloud is formed at so low a level that it rests on the ground or on the surface of the sea, it is known as *fog,* but when it presents only a faint cloudiness it is called *mist.* Fogs often appear at sea when the cold winds from icebergs blow across a warm region where the atmosphere is filled with moisture; the manner in which they form under such conditions is explained in the article HUMIDITY. A warm wind blowing into a cold atmosphere will form fog, and many of the fog banks and cloud banks so common off

the coast of Newfoundland are formed in this way. No fog will appear until the cold air has absorbed as much vapor as it can hold. It forms sometimes suddenly; the hot steam coming out of a kettle shows how rapidly the moisture in warm air is condensed when it reaches much cooler air. In seasons of the year when there is considerable difference in temperature during different hours of the day fogs are most frequent; this is seen in mountain valleys, where they are formed by the cooling of the lower air at night but usually disappear in the morning sunshine. The disagreeable odor of heavy fog in large cities is due to smoke and the many impure gases which it collects. See CLOUD.

Fog Signals are warnings issued to vessels by means of sound when, owing to the presence of fog, other signals would be invisible. Many kinds of signals are used, including horns, whistles, bells and guns. By means of these devices, agreed upon at the International Marine Conference held at Washington in 1890, vessels that are completely hidden from sight in the fog may enable other vessels to locate their positions and avoid the risk of collision. Lighthouses are equipped with fog signals for use when the light is obscured.

The most powerful fog signal is a large steam siren (see SIREN, for illustration). The sound issues from a long iron horn swung on a pivot, which makes it possible to turn it in any required direction. Under favorable conditions the sound of a very large siren may be heard at a distance of thirty miles. Fog signals generally used on railways consist of bombs or torpedoes attached to the rails and exploded by the engine as it passes over them.

Consult *United States Monthly Weather Review*, January, 1914, for an excellent discussion of the subject.

FOLK, JOSEPH WINGATE (1869-), an American lawyer, political reformer and ex-governor of Missouri, was born in Brownsville, Tenn. He was graduated from Vanderbilt University in 1890 and was admitted to the bar the same year. After practicing law in Brownsville for four years he removed to Saint Louis and became circuit attorney, in which office he prosecuted a number of notable bribery cases and exposed a large amount of political intrigue. In 1905 he was elected governor of Missouri on the Democratic ticket, carrying the state by 30,000 majority. He was the author of the two-cent fare railroad law in that state, the child labor law, and the law to remove officials for non-enforcement of statutes. He was appointed solicitor for the Department of Labor in 1913 by President Wilson, and in 1914 was appointed chief counsel for the Interstate Commerce Commission.

FOLK'LORE, a fascinating study which concerns itself not with learned volumes and the thoughts of scholars, but with the traditions, customs, superstitions, games, songs and proverbial sayings of the great mass of common people. In Europe it centers around peasant life. The further back these things date, and the more thoroughly unspoiled they are by any hint of book lore, the more does the folklore student revel in them. If he can find in some peasant family a quaint saying, a jingle or a nickname that has been handed down by word of mouth generation after generation, he feels that he has unearthed a treasure as surely as does the archaeological collector who discovers a rare specimen. Many of these treasures have given infinite pleasure to people who have no thought or knowledge of folklore, for the Mother Goose rhymes, the old ballads, Grimm's fairy stories and many of Andersen's, and such famous tales as *Cinderella* and *Red Riding-Hood,* were all possessions of the people long years before they were collected and put into book form.

The students of folklore make their discoveries serve a good purpose. For instance, if there is found to be a close similarity in the myths or traditions of two widely-separated peoples, the student may conclude that either there was communication between them at some time in the past, or similar conditions among them have called forth similar explanations or sayings. Sociology, ethnology, history, mythology and comparative religion all profit by the study of folklore, and matters apparently very trivial may serve to indicate principles of considerable value.

Consult Hazlitt's *Faiths and Folklore: a Dictionary of National Beliefs;* Mable's *Folk Tales Every Child Should Know.*

FOND DU LAC, *fon doo lak',* WIS., the county seat of Fond du Lac County, situated near the southeastern part of the state, at the southern extremity of Lake Winnebago, at the point where it receives the waters of the Fond du Lac River. Appleton is thirty-seven miles north, Milwaukee is sixty-three miles southeast, and Madison is eighty-nine miles southwest. The Chicago & North Western; the Chicago, Minneapolis & Saint Paul, and the Minneapolis, Saint Paul & Sault Sainte Marie

railways enter the city, and electric lines extend through the Fox River Valley north to Green Bay. The first settlement was made by French and Germans in 1836; it was incorporated as a village in 1847, and a city charter was granted in 1852. In 1914 the commission form of government was adopted. In 1910 the population was 18,797; it increased to 21,113 by 1916. The area is six square miles.

Fond du Lac is a busy manufacturing city, about 7,000 people being employed in its eighty factories; the largest of these make church furniture, caskets, leather and refrigerators, butter and cheese. Its bank, school and church buildings excel those of the average city of its size. Besides these it has a Federal building, a $100,000 courthouse, a $55,000 theater, an armory, an imposing high school building, a Masonic Temple, a Y. M. C. A. building, Saint Agnes Hospital, the state insane asylum and the state women's reformatory. In addition to its public and parochial schools it has Grafton Hall (Episcopal), Saint Mary's Academy (Catholic) and a Carnegie Library. Fond du Lac is the seat of an Episcopal bishopric. F.M.G.

FONTAINEBLEAU, *fon tan blo'*, a town in France, thirty-five miles southeast of Paris. It is chiefly celebrated for its chateau, which is rich in historic interest and one of the most magnificent in France. Its apartments were lavishly decorated under different reigns since that of Francis I, and still preserve much of their original character. The forest surrounding the chateau comprises 42,500 acres, and is world-famous. Fontainebleau was the scene of the abdication of Napoleon in 1814; the revocation of the Edict of Nantes was signed here in 1685, as was the peace preliminary agreement between Great Britain, France, Spain and Portugal in 1762. The town figures prominently in many historic romances, notably those of Dumas.

FOO-CHOW. See FU-CHOW.

FOOD. Whatever is taken into the system to supply nourishment, maintain the temperature of the body, furnish energy and provide material for growth is *food*. The body contains about twenty different elements, or simple substances, the twelve most important being carbon, hydrogen, oxygen, nitrogen, sodium, potassium, calcium, magnesium, chlorine, phosphorus, sulphur and iron. These elements are [illegible] into hundreds of different compound [illegible] all of which are indispensable to [illegible] working of the system. To maintain these substances in the body in proper proportions food must be supplied at fairly regular intervals, in suitable quantities (neither too little nor too great) and of sufficient variety.

Work of the Body. Careful investigations have shown that there is a loss from the body of a man of average size of about nine pounds of matter every twenty-four hours, not including the undigested portion of food, which is thrown off as waste. Of this nine pounds, seven and a half are water, but the other one and a half pounds were solid matter in the body, although they are eliminated from the body either as gas or in solution in water. The heat given off by the body during this period is sufficient to raise the temperature of fifty pounds of water from the freezing to the boiling point, or to heat its own weight of water from the freezing point to the body-temperature. To produce this heat the body consumes this one and a half pounds of solid matter by a process resembling that of burning the food. Although the body does not become nearly as hot as a furnace, the food materials combine with oxygen from the air—as they do in burning—and yield carbon dioxide, water and salts, the same products, or at least approximately the same, that they yield when burned.

Chemistry of Foods. Foods contain the same elements as are found in the body, otherwise they could be of little or no value; in other words, what we call food would not be food at all. We must first of all, then, look for nitrogen, hydrogen, oxygen and carbon, since these elements enter into the composition of the body in larger proportions than any others. Next in importance come calcium and phosphorus, which are found in large proportions in the bones, and finally iron, a small proportion of which is required in the blood.

According to their composition the chief substances contained in foods are generally divided into the following classes:

Proteins. In the first class are those containing nitrogen as one of their elements. This class takes the name *protein,* which means *of first importance.* Such foods as lean meat, cheese, milk, eggs, nuts and peas and beans are rich in proteins. The dry white of egg is nearly all protein and so is the gummy *gluten,* which we have left when we chew wheat for a long time, or when we wash dough under running water until all the starch has been carried away. Proteins are the most important

food substances, since they nourish the muscular tissues. During every moment of life the protein supply of the body is being drawn upon, and unless this supply is adequately replenished from the food, the body loses weight and grows weak.

Carbohydrates. The second class includes those which contain carbon, hydrogen and oxygen, with the latter two in the same proportions as in water. This class is represented by starch and sugar, which are known as *carbohydrates*

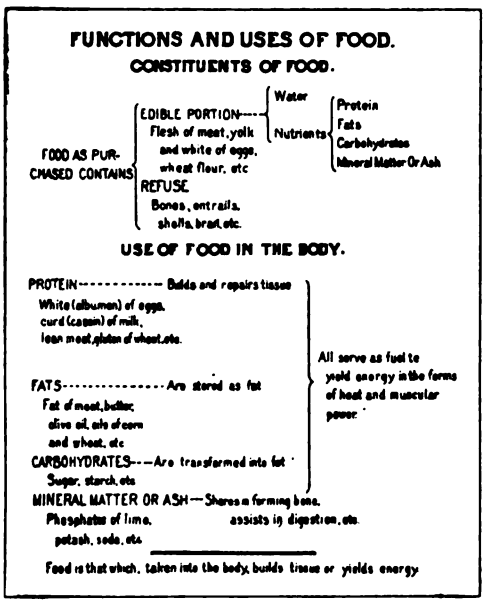


DIAGRAM OF FUNCTIONS AND USES OF FOOD

The above chart is published by the United States Department of Agriculture, size 17x22, suitable for hanging in a schoolroom.

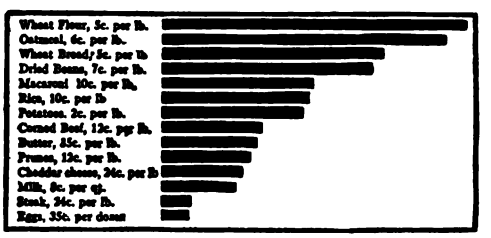
(from *carbon* and the Greek *hudor,* meaning *water*). The carbohydrates are obtained from vegetables, with the exception of milk-sugar, which is made from milk. Wheat flour, potatoes, carrots and beets owe their value as foods largely to the carbohydrates they contain. So also do all the common fruits, such as apples, oranges and grapes.

Fats. The third class includes those substances which contain *hydrogen* and *carbon,* with a smaller proportion of oxygen than the carbohydrates. These are known as *fats.* Lard, butter and olive oil are good examples. Fat meat, egg-yolk, nuts and some classes of fish, such as salmon, shad and eels, contain a large proportion of fats. The chief purpose of these foods is to furnish fuel. For this purpose they are much more valuable than the foods of the other classes, one pound of fat yielding two and one-fourth times as much heat as one pound of protein or carbohydrate. They are more difficult to digest than the starches and sugars, and give the best results when mingled with a certain proportion of these foods. See FAT.

Inorganic Substances. The fourth class includes all the inorganic substances used as food; that is to say, all the substances which do not contain the element carbon. With the exception of water, which forms about six-tenths of the weight of the body, and common salt, which we add to our food, we get the inorganic substances in sufficiently large quantities in the ordinary articles of food of a well-balanced diet to supply the demands of the body.

Water. The amount of water or "moisture" contained in foods varies greatly. Thus, sugar and olive oil contain no water; wheat flour contains about twelve per cent; bread, about thirty-five per cent; average of beef, about sixty per cent; grapes, seventy-seven per cent; potatoes, seventy-eight per cent; turnips, ninety per cent; watermelon, ninety-two per cent, and tomatoes and celery nearly ninety-five per cent. One cannot make an accurate estimate of the amount of water in a food by merely looking at it or feeling it. Who would suspect that flour contains any moisture or that turnips have more than potatoes or grapes? It is only by actual drying and weighing that we can find out how much of any food is water and how much is solid matter.

Refuse. As bought in the market, most articles of food contain parts that are not or cannot be eaten, such as the bone and gristle in meat, the skins of vegetables and seeds of fruits. These parts are refuse, or waste, the proportion of which should receive careful consideration in the purchase of food.



THE FOOD VALUE IN TEN CENTS

Food as Fuel. The fuel value of food is measured by a heat unit called the *calorie* (which see). A calorie is the amount of heat required to raise the temperature of a kilogram

of water one degree centigrade; this is practically the amount necessary to heat one pound of water four degrees Fahrenheit. Careful experiments have determined the fuel values of the different classes of foods to be as follows:

Protein, 4 calories per gram, or 1,820 calories per pound.

Fats, 9 calories per gram, or 4,040 calories per pound.

Carbohydrates, 4 calories per gram, or 1,820 calories per pound.

All nutritious foods are fairly good fuels, but not nearly so good as pure fats. One can readily see why people living in a temperate climate eat more fat in winter than in summer, why the Eskimo drinks his blubber with relish, and why people of the tropics eat little or no fat.

Digestibility of Food. "We live not upon what we eat, but upon what we digest." Food must undergo a number of chemical changes before it becomes suitable to nourish the body. Digestibility is an important consideration in selecting food. This means not only the ease with which a given article of food is digested, but also the amount of nutriment it will yield. The time required for digestion depends upon the class of food, the quantity and the condition of the stomach. The following table, based upon investigations made by the United States Department of Agriculture, published in *Bulletin 142*, contains valuable information concerning various articles of food ordinarily used in a mixed diet:

KIND OF FOOD	PROTEIN		FAT		CARBOHYDRATES	
	Digestibility	Fuel value per pound	Digestibility	Fuel value per pound	Digestibility	Fuel value per pound
	Per cent	*Calories*	*Per cent*	*Calories*	*Per cent*	*Calories*
Meats and fish	97	1,940	95	4,040	98	1,730
Eggs	97	1,980	95	4,090	98	1,730
Dairy products	97	1,940	95	3,990	98	1,730
Animal food (of mixed diet)	97	1,940	95	4,050	98	1,730
Cereals	85	1,750	90	3,800	98	1,860
Legumes (dried)	78	1,570	90	3,800	97	1,840
Sugars	.....	.....	.....	.....	98	1,750
Starches	.....	.....	.....	.....	98	1,860
Vegetables	83	1,410	90	3,800	95	1,800
Fruits	85	1,520	90	3,800	90	1,630
Vegetable foods (of mixed diet)	84	1,840	90	3,800	97	1,820
Total food (of mixed diet)	92	1,820	95	4,050	97	1,820

Mixed Diet. From the foregoing statements [illegible] be seen that while man may [illegible] sively vegetable diet or an [illegible] diet, he will preserve his health and maintain his strength much better on a mixed diet. All the organs and tissues of the body contain proteins; proteins are the only substances that can supply nitrogen, and comparatively few vegetable foods are rich in proteins. Nine-tenths of the fat in an ordinary diet is supplied by animal foods, and about nine-tenths of the starch and sugar by vegetable foods. Since small quantities of mineral matter are found in all foods, a mixed diet supplies the body's needs.

Quantity of Food. The quantity of food needed depends upon a number of conditions. These are:

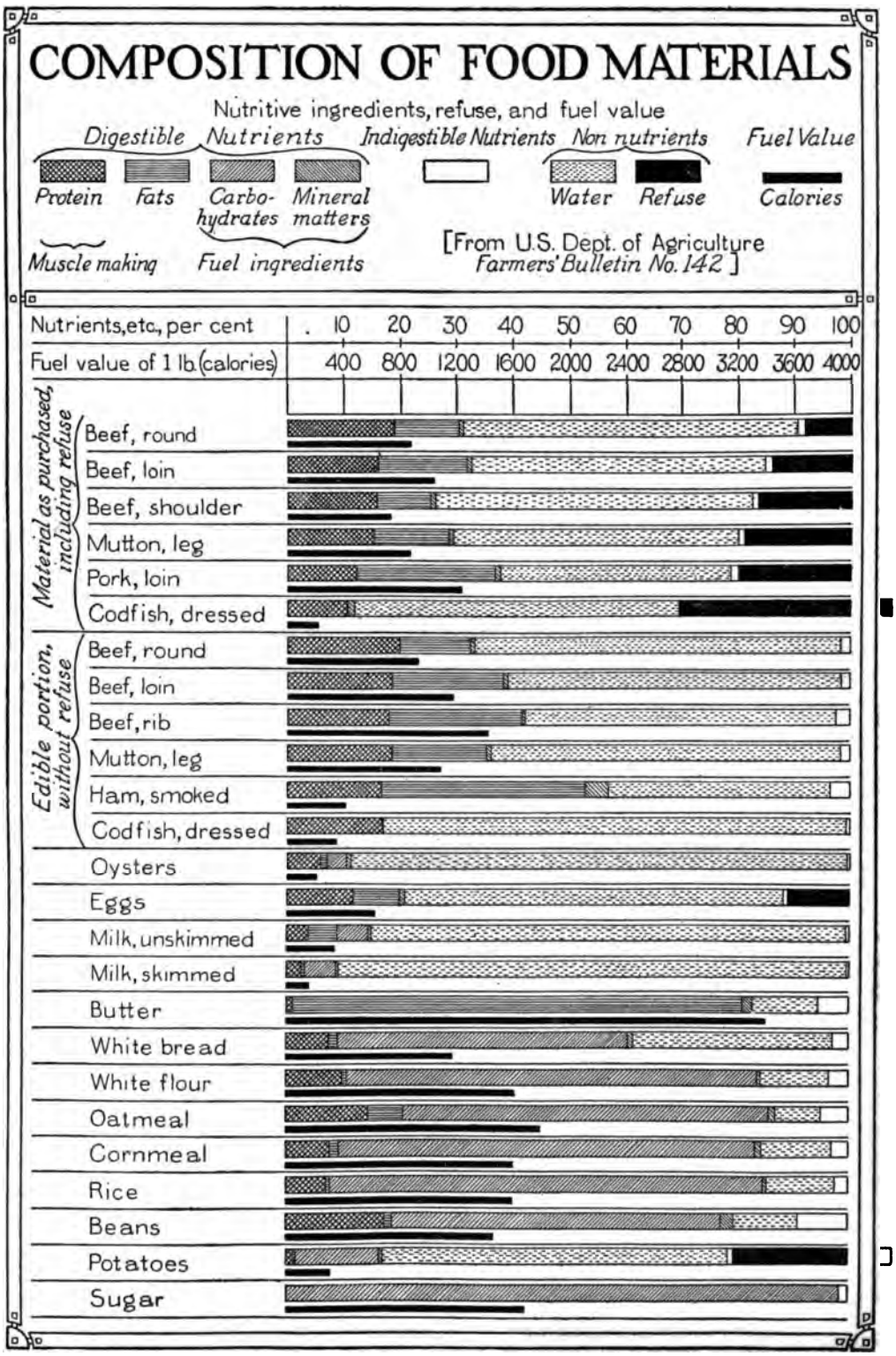
Sex. Men, being larger and more active than women, require more food. The average woman eats about four-fifths as much as the average man.

Age. A growing child requires proportionately more food than an adult. Boys and girls over fourteen eat nearly as much as adults of the same sex. An aged person requires less food than one in middle life. After the age of sixty the diet may be reduced about one-tenth for every ten years of age.

Occupation. A man engaged in manual labor in the open air, as a lumberman or stonecutter, for instance, requires more food than a clerk or one working at a desk.

Climate. People living in cold climates require more food than those living in temperate and tropical climates. People in temperate climates require more food in winter than in summer.

Planning Meals. With such a knowledge of foods as is here outlined, the housewife can plan meals so as to meet the physiological needs of her family, give a good variety of


COMPOSITION OF FOOD MATERIALS
Nutritive ingredients, refuse, and fuel value
Digestible Nutrients
Indigestible Nutrients
Non nutrients
Fuel Value
Protein
Fats
Carbo-hydrates
Mineral matters
Water
Refuse
Calories
Muscle making
Fuel ingredients
[From U.S. Dept. of Agriculture Farmers' Bulletin No. 142]
Nutrients, etc., per cent
10 20 30 40 50 60 70 80 90 100
Fuel value of 1 lb. (calories)
400 800 1200 1600 2000 2400 2800 3200 3600 4000
Material as purchased, including refuse
Beef, round
Beef, loin
Beef, shoulder
Mutton, leg
Pork, loin
Codfish, dressed
Edible portion, without refuse
Beef, round
Beef, loin
Beef, rib
Mutton, leg
Ham, smoked
Codfish, dressed
Oysters
Eggs
Milk, unskimmed
Milk, skimmed
Butter
White bread
White flour
Oatmeal
Cornmeal
Rice
Beans
Potatoes
Sugar

appetizing food and prevent waste. She should always bear in mind that that food is the cheapest which supplies the greatest amount of nutriment at the lowest cost. The following estimate prepared by the United States Department of Agriculture will be found a safe guide:

Man at hard muscular work requires 1.2 times the food of a man at moderately active muscular work.

Man with light muscular work, and boy 15-16 years old, require 0.9 the food of a man at moderately active muscular work.

Man at sedentary occupation, woman at moderately active work, boy 13-14, and girl 15-16 years old, require 0.8 the food of a man at moderately active muscular work.

Woman at light work, boy 12, and girl 13-14 years old, require 0.7 the food of a man at moderately active muscular work.

Boy 10-11 and girl 10-12 years old require 0.6 the food of a man at moderately active muscular work.

Child 6-9 years old requires 0.5 the food of a man at moderately active muscular work.

Child 2-5 years old requires 0.4 the food of a man at moderately active muscular work.

Child under 2 years old requires 0.3 the food of a man at moderately active muscular work.

The following table, prepared by the Illinois Food Commission, is of value in determining the relative cost of various articles of food. A quart of milk is taken as the standard. While the prices may vary from those here given, the relative value as compared with milk will remain practically the same:

KIND OF FOOD	COST	NUMBER OR MEASURE	WEIGHT GRAMS	WEIGHT Lb.	WEIGHT Oz.	TOTAL COST
Milk	$0.08 per Qt.	1 Qt.	976	2	2	$0.08
Cheese (1)	0.22 " Lb.		193.3		6.8	0.093
Eggs	0.35 " Doz.	10	566	1	3.9	0.29
Meat (2)	0.22 " Lb.		307.7		10.8	0.148
Codfish (3)	0.15 " Lb.		428.5		15.1	0.141
Potatoes (4)	1.00 " Bu.	7	722.7	1	9.4	0.026
Bread (5)			188.6		6.6	0.025
Cornmeal	0.03 " Lb.		137.7		4.9	0.009
Cabbage	0.025 " Lb.	1 Head	1875	4	2.2	0.10
Dried Beans	0.06 " Lb.		143		5.05	0.018
Oranges	0.40 " Lb.	8	1304.4	2	14.0	0.226
Apples	0.60 " Pk.	12	1052.6	2	5.1	0.092
Bananas	0.20 " Doz.	5	774	1	11.3	0.10
Prunes	0.15 " Lb.		187.5		6.62	0.061
Nuts	0.60 " Lb.		128.7		4.5	0.168

1. Full Cream Cheese. 2. Meat—Fat, Round Beef. 3. Codfish—Boneless.
4. Potatoes—60 Lb. to Bushel. 5. Bread—White.

Meat Extracts. Manufacturers and dealers in meat extracts advertise them as having a high nutritive value, whereas the best authorities state that they have no nutritive value whatever, but that their value lies wholly in their effectiveness as stimulants and appetizers. "In brief," says one of these authorities, "beef-tea is the poker, nutriment is fuel; and heat can no more be obtained from a poker than the body can be nourished on ordinary extract of meat or beef-tea." A cup of hot bouillon on a cold day is a good stimulant, but it does not take the place of a steak.

Cuts of Meat. Many think that the more expensive the cut of meat the more nutritious it is, when often the contrary is true. To illustrate, the flank of beef has a much higher nutritive value than the loin, which usually costs twice as much. Moreover, when the cheaper cut is properly cooked it is equally palatable. The food value of veal is about one-half that of beef.

Delicacies. The food value of brains, kidneys, livers, oysters, lobsters and clams is low, while some of them are difficult to digest.

Bread and Meat. Meat usually supplies more fat, and consequently more fuel, than bread, but the total food value of bread per pound is equal to or greater than that of most cuts of meat.

Breakfast Foods, etc. Manufacturers and dealers rate the various cereal preparations far above their actual nutritive value. To illustrate, a preparation of wheat may contain no

Popular Errors. There are a few common [illegible] concerning food values which need attention. [illegible] following them often leads to unnecessary expense or more serious consequences.

more nutriment than wheat or graham flour, but it is sold for two or three times the price of the flour. While these foods are pleasant, they are not economical.

The full page table accompanying this article, prepared by the United States Department of Agriculture and published in *Bulletin 142,* is valuable for reference.

Consult Carpenter's *Food and Their Uses;* Chamberlin's *How We Are Fed;* United States Department of Agriculture *Bulletin 142.*

Related Subjects. The following articles contain much information bearing on this very important subject. Many of the topics, as FISH, FRUITS, GRAINS, MEAT, VEGETABLES, have themselves lists of related topics, to which the reader is referred, so that the range of reading here indicated is a wide one.

Adulteration
Albumen
Baking Powder
Benzoate of Soda
Blanc-mange
Boys' and Girls' Clubs
Bread
Breakfast Foods
Butter
Calorie
Candy
Canning Clubs
Carbohydrates
Casein
Caviar
Cheese
Chile-con-carne
Chocolate
Cocoa
Coffee
Cold Storage
Cookery
Copra
Diet
Digestion
Edible Bird's Nest
Egg
Fat
Fireless Cooker
Fish (see list)
Flour
Food Products, Preservation of
Fruits (see list)
Gelatin
Glucose
Gluten
Grains (see list)
Honey
Irish Moss
Jelly
Ketchup
Lard
Macaroni
Meat (see list)
Molasses
Nutrition
Oleomargarine
Paprika
Peptones
Pemmican
Pickles
Proteids
Proteins
Pure Food Laws
Raisins
Saccharin
Salt
Spice
Starch
Sugar
Tapioca
Tea
Vegetables (see list)
Vinegar
Water
Yeast

FOOD PRODUCTS, PRESERVATION OF. The annual production of food in the United States is sufficient to feed twice the population of the whole American continent. The areas of production, however, are frequently far distant from the center of population, and the distribution of foodstuffs, especially of perishable products, such as fruits and vegetables, is a serious problem. Large quantities of such foods are shipped by rail in refrigerator cars, but the cost of transporting them in this manner is very great, and the price demanded of the consumer is correspondingly high. Some fruits and vegetables are placed in cold storage, but this, too, is expensive, and the foods so preserved become luxuries. A few fruits are dried, but they are not so palatable as the fresh fruits, and the demand for them is light. It is evident, then, that these methods of preservation take care of only a small part of the annual production and do very little toward distributing it among the population and preserving it for out-of-season use.

The great bulk of perishable food produced is sealed in cans and so shipped to any distance and kept for any period of time without danger of deterioration. During the year 1916 over 300,000,000 cans of food were preserved in commercial canneries, and according to a conservative estimate, 150,000,000 quarts were canned in homes. Canned food is cheaper than cold storage food and has more nearly the flavor of the fresh product than has food that is dried. Any food product exposed to the air decomposes. This decomposition is caused by small organisms, visible only through the most powerful microscope, which grow and multiply in it. *Freezing,* as applied in cold storage plants, arrests the activities of these organisms; *drying* retards their development in some products; *heat,* properly applied, kills them.

Methods of Canning. There are four methods of canning now in general use: (1) The hot pack, or open-kettle, method; (2) the fractional, or three-day, method; (3) the cold water method; (4) the cold-pack method.

The *hot-pack,* or *open-kettle, method* has been in use in homes for years. The food is boiled or sterilized in one kettle, the jars, caps and rubbers, in another. Then the sterilized food is ladled into the sterilized jars and the jars are sealed. This method is only partially successful, because frequently a spore or organism from the air is ladled into the jar with the food, and decomposition results.

The *three-day,* or *fractional, method,* often called the *laboratory method,* is based on a knowledge of the development of spores and organisms. Scientists have discovered that boiling temperature will kill organisms, but that a considerable period of boiling temperature is required to destroy spores. By the three-day method the food is boiled in the jar on the first day to destroy organisms, on the second day to destroy organisms developed from spores not destroyed by the first boiling,

and on the third day to sterilize any organisms that were slow in developing. This method has never come into general use, for several reasons. It involves a great amount of labor, requires a great quantity of fuel, and destroys jar rubbers, which are not made to withstand so many boilings.

The *cold-water process* is practicable only for fruits high in acid, such as gooseberries, rhubarb and cranberries. Its application is so limited and its results so uncertain that it is little used. It consists simply in packing the fruit into a jar, filling the jar to overflowing with cold, sterilized water and sealing.

The *cold-pack method* has been in use by commercial canners for years, but it has only recently been made available for housewives and boys and girls engaged in garden and canning club work. This method is safe, certain and economical for home canning of food products.

The most common type of container used in the work is the Mason type of glass jar. This jar has a zinc or aluminum screw top, with a rubber ring that fits between the glass and the top; the rubber makes the container air-tight when the top is screwed tight on the jar. The glass top jar permits no food to come in contact with metal, and is considered a little more sanitary than the zinc top container. A rubber ring is fitted between the glass top and the jar, and a clamp spring is provided that may be tightened as soon as sterilization is complete.

The Economy, or vacuum, jar has a metal top coated with gold lacquer and provided with a vegetable fiber ring attached to the metal top. Where food products are packed by commercial concerns, tin cans are commonly used. These cans are often classified as "packers' cans," with solder-hemmed caps, and "sanitary cans," which are hermetically sealed by machines especially made for the purpose (see illustration).

No special equipment is required to can by the cold-pack process. Glass jars or containers found in the home may be used. A satisfactory sterilizer or hot water bath outfit may be made by placing a wooden rack in the bottom of a tall can or vessel to support the jars. Four rules cover the instructions for the operation of this home-made sterilizer:

(1) Have a rack in the bottom of the sterilizer that will permit the water to circulate under it and over the top of the jars.

(2) The water cover the jars by at least

(3) Count the time as soon as the water begins to jump.

(4) Remove the jars from the sterilizer at the close of the sterilizing period and tighten the covers.

There are numerous commercial hot water bath outfits on the market, some provided with stove attachments and others arranged for heating on top of the family cookstove. These commercial outfits have a convenient arrangement for lifting the jars in and out of the sterilizer. The sterilizing period for the home-made hot water bath outfit and for the commercial hot water bath outfit is the same.

The steam pressure sterilizers can be conveniently divided into three classes, as follows: (a) Water-seal, or 214-degree outfit (see illustration); (b) the five-pound steam pressure, or 228-degree outfit; (c) the fifteen-pound steam pressure, or 250-degree outfit. All steam pressure outfits are provided with a safety valve to prevent too much pressure on the sterilizer, a pet cock to release the pressure before opening the canner, and a steam gauge or thermometer to indicate the pressure maintained on the outfit. Each type of outfit will do the work successfully, if properly operated. In the recipes given below, time tables are printed for sterilizing in the hot water bath, the 214-degree outfit, the five-pound steam pressure outfit and the fifteen-pound pressure outfit:

Fruits

Soft Fruits. Strawberries, blackberries, dewberries, sweet cherries, blueberries, apricots, grapes, plums, huckleberries.

Recipe for canning soft fruits. Can the same day fruit is picked. Grade and rinse the fruit by pouring water over it through a strainer. Cull, seed and stem. Pack immediately in glass jars or tin cans. Add boiling hot sirup of eighteen per cent density (thin). Place rubber and top in place. Partially tighten. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used.

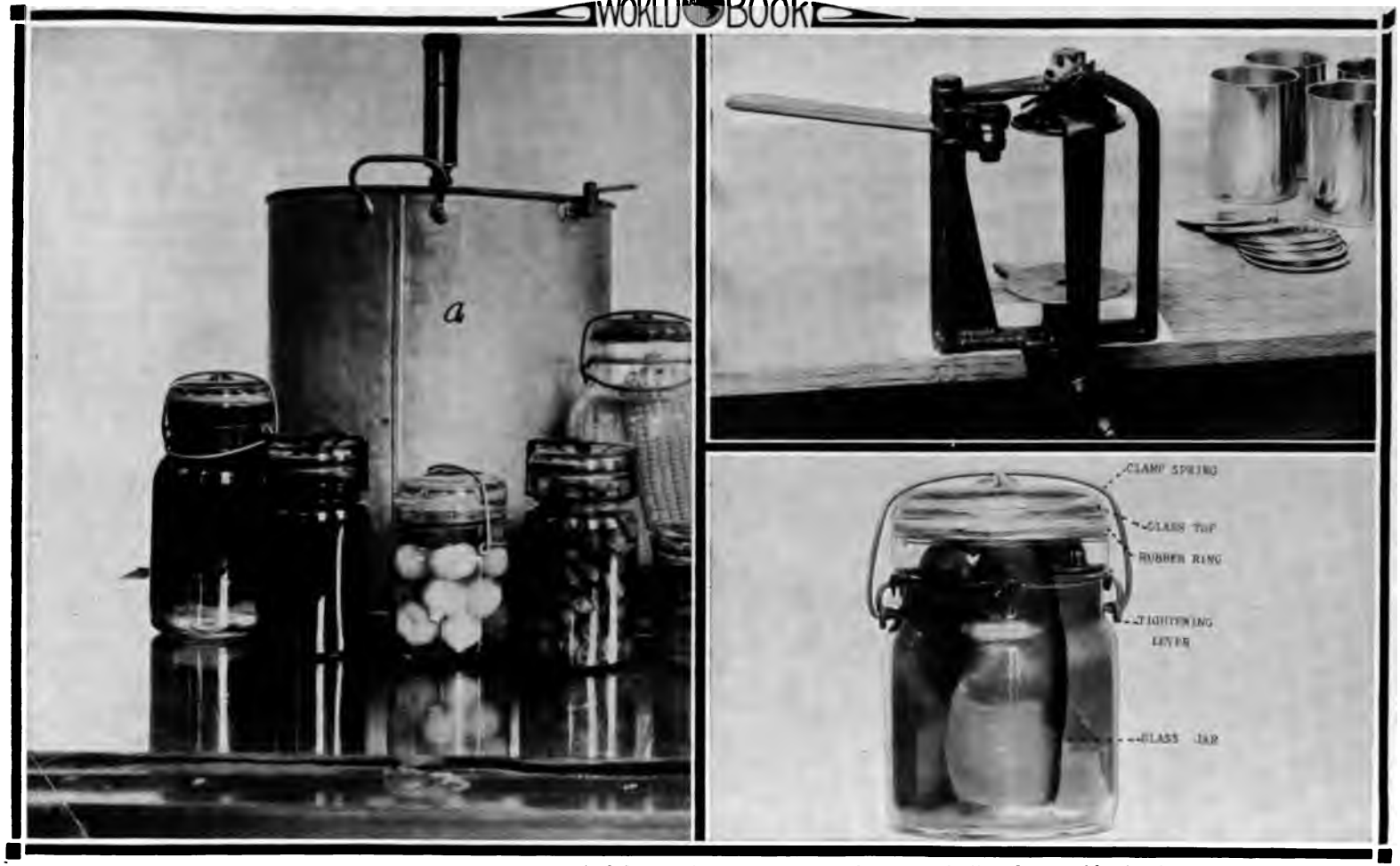
	MINUTES
Water bath	16
Water seal at 214°	10
Steam pressure 5 pounds	8
Steam pressure 10 pounds	5

Remove the jars. Tighten the covers. Invert the jars to cool and test the joint. Wrap the jars with paper to prevent bleaching.

(Sirup: one and one-half quarts of sugar to one quart of water, boiled to medium thickness.)

Sour Berry Fruits. Currants, gooseberries, cranberries and sour cherries.

Recipe for canning sour berry fruits. Can same day picked. Steam, hull and clean. Blanch in hot water one minute. Remove and dip quickly in cold water. Pack berries closely in container. Add hot sirup of twenty-eight per cent density



APPARATUS FOR CANNING.

At left: (*a*) is a water-seal 214° canner; fruit and vegetables in glass jars. Right, above: Hand-sealing device for sanitary cans; cans and caps on table. Below: parts of glass jar.

A CANNING CLUB MEMBER AT HOME.

Filling jar with boiling water. A fifteen-pound steam pressure canner is shown on gas stove.

until full. Place rubber and cap in place. Seal partially, not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	16
Water seal, 214°	12
Steam pressure 5 pounds	10
Steam pressure 15 pounds	5

Remove the jars. Tighten the covers. Invert the jars to cool and test the joint. Wrap the jars with paper to prevent bleaching.

Hard Fruits. Apples, pears, quinces, peaches, pineapple, figs.

Recipe for canning hard fruits. Grade, blanch one and one-half minutes, and plunge quickly in cold water. Core, pit, or remove skins, if necessary. Pack whole, quartered, or sliced, as desired. Add boiling-hot sirup of from eighteen to twenty-eight per cent density (medium thin). Place rubbers and tops in position. Partially tighten. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	20
Water seal, 214°	12
Steam pressure 5 pounds	8
Steam pressure 15 pounds	6

Remove the jars. Tighten the covers. Invert the jars to cool and test the joint. Wrap the jars with paper to prevent bleaching.

Vegetables

Vegetable greens, both wild and cultivated.

Recipe for canning vegetable greens. Prepare and can the day picked. Sort and clean. Blanch in a vessel with a little water under false bottom or in a regular steamer, fifteen to twenty minutes. Remove. Plunge quickly into cold water. Cut in convenient lengths. Pack tight in jar or container and season to taste; add a little chipped beef, olive oil, etc. Add hot water to fill crevices, and a level teaspoonful of salt to each quart. If using glass jars, place rubber and top in position, partially seal; if using tin cans, cap and tip completely. Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	120
Water seal, 214°	90
Steam pressure 5 pounds	80
Steam pressure 15 pounds	45

Remove from canner. Tighten covers. Invert to cool and test joints. Wrap in paper to prevent bleaching and store.

Root and Tuber Vegetables. Carrots, parsnips, beets, turnips, sweet potatoes.

Recipe for canning root and tuber vegetables. Grade for size, color and degree of ripeness. Wash thoroughly. Use vegetable brush. Scald in boiling hot water sufficiently to loosen skin. Plunge quickly in cold water. Scrape or pare to remove skin. Pack whole or cut in sections or cubes, as required by the home or market standard. Add boiling hot water and one level teaspoonful of salt to the quart. Place rubbers and tops in position. Partially seal, but not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	90
Water seal, 214°	75
Steam pressure 5 pounds	60
Steam pressure 15 pounds	40

Remove the jars. Tighten the covers. Invert the jars to cool and test the joint. Wrap the jars with paper to prevent bleaching.

Special Vegetables. Tomatoes and corn.

Recipe for canning tomatoes. Grade for size, ripeness and color. Scald in hot water enough to loosen skins. Plunge quickly in cold water. Remove. Core and skin. Pack whole. Fill container with whole tomatoes only. Add one level teaspoonful of salt to each quart. Place rubber and cap in position. Partially seal, but not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	22
Water seal, 214°	18
Steam pressure 5 pounds	15
Steam pressure 20 pounds	10

Remove jars. Tighten covers. Invert to cool and test joints. Wrap jars in paper and store.

Recipe for canning sweet corn on the cob. Can corn the same day picked. Remove husks, silks and grade for size. Blanch on the cob in boiling water five to fifteen minutes. Plunge quickly in cold water. Pack ears, alternating butts and tips, in half-gallon glass jars or gallon tin cans. Pour over boiling hot water and add two level teaspoonfuls of salt to each gallon. Place rubbers and tops in position. Seal partially but not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	180
Water seal, 214°	90
Steam pressure 5 pounds	60
Steam pressure 20 pounds	35

Remove jars. Tighten covers. Invert to cool and test joints. Wrap glass jars with paper and store.

NOTE. When sweet corn is taken from jar or tin can for table use, remove ears as soon as jar or can is opened. Heat corn, slightly buttered, in steamer. Do not allow ears to stand in water or to be boiled in water the second time.

Recipe for canning sweet corn cut from cob. Can the same day as picked. Remove husks and silks. Blanch on the cob in boiling hot water five to fifteen minutes. Plunge quickly in cold water. Cut the corn from the cob with a thin, sharp-bladed knife. Pack corn in jar tightly until full. Add one level teaspoonful of salt to each quart and sufficient hot water to fill. Place rubbers and tops in position. Partially seal, but not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the type of outfit used:

	MINUTES
Water bath	180
Water seal, 214°	90
Steam pressure 5 pounds	60
Steam pressure 20 pounds	35

Remove jars. Tighten covers. Invert to cool and test joints. Wrap with paper and store.

Other Vegetables. Lima beans, string beans, peas, okra.

Recipe for canning. Can same day vegetables are picked. Cull, string, grade. Blanch in boiling hot water for two to five minutes. Remove and plunge quickly in cold water. Pack in container until full. Add boiling hot water to fill crevices. Add one level teaspoonful of salt to each quart. Place rubbers and tops in position. Partially seal, but not tight. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	120
Water seal, 214°	90
Steam pressure 5 pounds	60
Steam pressure 20 pounds	40

Remove jars. Tighten covers and invert to cool. Wrap jars in paper and store.

Canning pumpkin and squash. Cut up into convenient sections. Core and remove skins. Cook for thirty minutes to reduce to pulp. Pack in glass jars or tin cans. Add one cup of sugar and one teaspoonful of salt to each quart of pulp. Place rubber and top in position. Partially seal, but not tight. Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	60
Water seal, 214°	50
Steam pressure 5 pounds	40
Steam pressure 20 pounds	30

Remove jars. Tighten covers. Invert to cool and test joints. Wrap in paper and store.

Preserves

Strawberry. Make a sirup of one quart of water and eleven pounds of sugar and cook it in an open kettle until a candy thermometer registers 265° when placed in the sirup. Add eight pounds of berries to the sirup. Cook very slowly, just at the boiling point. Stop the cooking when the thermometer registers 219° and pour into shallow pans to cool. Hasten the cooling by pouring sirup over the berries. Skim while cooling. Fill into jars when cold and allow them to stand unsealed for four days. Put the rubber and cap in position, not tight. (Cap and tip if using enameled tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	20
Water seal, 214°	15
Steam pressure (see note under cherry preserves)	15

Remove the jars. Tighten the covers. Invert the jars to cool and test the joint. Wrap the jars in paper to prevent bleaching.

Cherry. Place one gallon of water in a kettle and add ten pounds of pitted cherries. Boil slowly for eighteen minutes. Add twelve pounds of granulated sugar and cook until the product is boiling at a temperature of 219°. Cool quickly in shallow pans. Pack into glass jars. Put the rubber and cap in position, not tight. (Cap and tip if using enameled tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	20
Water seal, 214°	15
Steam pressure (see note)	15

NOTE. When using pressure-cooker outfits on preserves, keep valve open during sterilization.

Sun Preserves

Strawberry. Select ripe, firm berries. Pick and preserve them the same day. Hull and rinse thoroughly. Place them in a shallow platter in a single layer; sprinkle sugar over them; pour over them 40° sirup (same as strawberry preserves, above, boiled thicker). Cover them with a glass dish or a plain window glass. Allow them to stand in the hot sun eight or twelve hours. Pack them in glass jars or cups; tie paper over the tops or cover with paraffin or sealing wax. Keep in cool, dry place.

Soups

Soup Stock. Secure twenty-five pounds of beef hocks, joints and bones containing marrow. Strip off the fat and meat and crack bones with a hatchet or cleaver. Put the broken bones in a thin cloth sack and place them in a large kettle containing five gallons of cold water. Simmer (do not boil) for six or seven hours. Do not salt while simmering. Skim off all fat. This should make about five gallons of stock. Pack hot in glass jars, bottles, or enameled or lacquered tin cans. Partially seal glass jars. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	40
Water seal, 214°	30
Steam pressure 5 pounds	30
Steam pressure 15 pounds	25

Check list of supplies to be provided before beginning work.

25 pounds of beef bones
5 gallons water

Vegetable Soup. Soak one-fourth pound lima beans and one pound rice for twelve hours. Cook one-half pound pearl barley for two hours. Blanch one pound carrots, one pound onions, one medium sized potato and one red pepper for three minutes and cold dip. Prepare the vegetables and cut into small cubes. Mix thoroughly lima beans, rice, barley, carrots, onions, potatoes, red pepper. Fill glass jars or the enameled tin cans.

Chicken-Soup Stock. Place thirty pounds chicken in ten gallons of cold water and simmer for five hours. Remove meat and bones, then strain. Add sufficient water to make ten gallons of stock. Fill glass jars or tin cans with the hot stock. Partially seal glass jars. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	90
Water seal, 214°	75
Steam pressure 5 pounds	60
Steam pressure 15 pounds	45

This stock is used to make soup where the term "chicken-soup stock" is employed.

Check list: 30 pounds chicken
10 gallons water

Vegetables (Mixed) Without Stock. Many people would like vegetable soup during the winter season, but find it impracticable to secure the soup stock during the summer season when the vegetables are so abundant that they are rotting in the garden. It is suggested that the vegetable portion of the soup be canned during the summer and made available when the soup stock is prepared during the winter. It makes the preparation of the soup a simple matter whenever the stock is available.

Soak six pounds of lima beans and four pounds of dry peas over night. Boil each one-half hour. Blanch sixteen pounds of carrots, six pounds of cabbage, three pounds of celery, six pounds of turnips, four pounds of okra, one pound of onions and four pounds of parsley for three minutes and dip in cold water quickly. Prepare the vegetables and chop them into small cubes. Chop the onions and celery extra fine. Mix all of the vegetables, and season to taste. Pack in glass jars or tin cans. Fill with boiling water. Partially seal glass jars. (Cap and tip tin cans.) Sterilize the length of time given below for the particular type of outfit used:

	MINUTES
Water bath	90
Water seal, 214°	60
Steam pressure 5 pounds	60
Steam pressure 15 pounds	45

Check list:

16 pounds carrots (small)	4 pounds okra
6 pounds cabbage	1 pound onions
3 pounds celery (stems and leaves)	4 pounds parsley
6 pounds turnips	4 pounds dry peas
6 pounds lima beans	Salt and pepper to taste

Meat

Poultry and Game

Recipe No. 1. Kill fowl and draw at once; wash carefully and cool, cut into convenient sections. Place in wire basket or cheesecloth and boil until meat can be removed from bones; remove from boiling liquid and remove meat from bones; pack closely into glass jars; fill jars with pot liquid, after it has been concentrated one-half; add level teaspoonful of salt per quart of meat, for seasoning; put rubber and cap in position, not tight; sterilize the length of time given below for the particular type of outfit you are using:

	HOURS
Water bath	3½
Water seal, 214°	3
Steam pressure 5 pounds	2½
Steam pressure 15 pounds	1

Remove jars; tighten covers; invert to cool and test the joint; wrap jars with paper to prevent bleaching.

Recipe No. 2. Kill fowl and draw at once; wash carefully and cool; cut into convenient sections and pack at once into glass jars; fill with boiling water; add level teaspoonful of salt per quart; put rubber and cap in position, not tight, and sterilize the length of time given below for the one particular type of outfit you are using:

	HOURS
Water bath	4
Water seal, 214°	3½
Steam pressure 5 pounds	3
Steam pressure 15 pounds	1

Remove jars; tighten covers; invert to cool and test the joint; wrap jars with paper to prevent bleaching.

Fresh Beef. As soon as beef has been killed, cool quickly and keep cool for about twenty-four hours. Cut the beef into convenient pieces for handling, about three-fourths pound in weight, and roast or boil slowly for one-half hour. Cut into small pieces, remove gristle, bone and excessive fat, and pack directly into glass jars; fill with gravy from the roasting pan, or pot liquid, concentrated to one-half its volume; put rubber and cap in position, not tight, and sterilize the length of time given below for the one particular type of outfit you are using:

	HOURS
Water bath	4
Water seal, 214°	4
Steam pressure 5 pounds	3½
Steam pressure 15 pounds	1½

Remove jars; tighten covers; invert to cool and test the joint; wrap jars with paper to prevent bleaching.

Corned Beef. After beef has been properly corned for required time, remove the meat from the brine; soak for two hours in clear water, changing the water once; place in a wire basket and boil slowly for one-half hour; remove from the boiling water, then plunge into cold water; remove gristle, bone and excessive fat; cut into small pieces and pack closely into glass jars; put rubber and cap in position, not tight, and sterilize the length of time given below for the one particular type of outfit you are using:

	HOURS
Water bath	4
Water seal, 214°	4
Steam pressure 5 pounds	3
Steam pressure 15 pounds	2

Remove jars; tighten covers; invert to cool and test the joint; wrap jars with paper to prevent bleaching.

Canned Pork. After the animal has been butchered, cool quickly, and keep the pork cool for at least twenty-four hours; can only lean portions, using the fat to make lard; place meat in a wire basket or cheesecloth and boil for thirty minutes, or roast in the oven for thirty minutes; cut into small sections and pack closely into glass jars; put rubber and cap in position, not tight; and sterilize the length of time given below for the one particular type of outfit you are using:

	HOURS
Water bath	4
Water seal, 214°	3
Steam pressure 5 pounds	3
Steam pressure 15 pounds	1½

Remove jars; tighten covers; invert to cool and test the joint; and wrap jars with paper to prevent bleaching.

Canned Salmon. Make a brine of salt and water that will support a potato, and after cleaning the fish properly, place in brine for one-half

hour; remove from brine; cut into convenient sections; and pack in glass jars, with the skin toward the outside. Add level teaspoonful of salt per quart; put rubber and cap in position, not tight; and sterilize for the length of time given below for the one particular type of outfit you are using:

	HOURS
Water bath	3
Water seal, 214°	3
Steam pressure 5 pounds	2½
Steam pressure 15 pounds	1½

Remove jars; tighten covers; invert to cool and test the joint; wrap the jars with paper to prevent bleaching. G.E.F.

Related Subjects. The reader is referred to the following articles in these volumes:

Boys' and Girls' Clubs Gardening
Canning Clubs School Garden

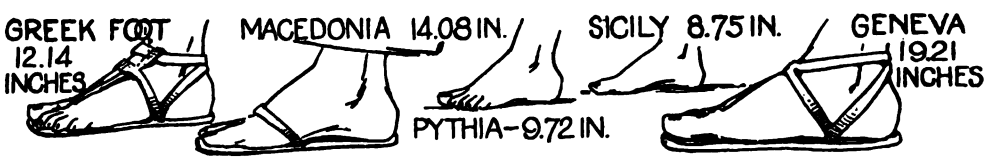
and to each fruit, vegetable or other product named in the text of the above article.

FOOLS, FEAST OF, a celebration of unknown origin, current between the fifth and sixteenth centuries in many countries of Europe, marked by merriment and absurdities of a boisterous nature. It was a Christian form of the Roman Saturnalia, and in common with that festival, occurred in December. The ceremonies usually consisted of dramatic representations, the principal church of the place serving as the theater, and if the clergy did not actually participate they formed an interested audience. One form of celebration consisted in the election of a mock pope, cardinal, archbishop, bishop or abbot, under the title of *Pope of Fools, Boy Bishop, etc.* On election day the mob took possession of the churches, and even mimicked the performance of the highest offices of the Church. The orgies which continued in many places until the sixteenth century, and in the south of France survived until 1644, became so marked by license and lawlessness that they were finally prohibited by the Church.

FOOT, a measure of length originally based on the length of the human foot, to which fact its name is due. The accompanying illustration shows how the standard has varied in different countries. In the English system, in general use in America and Great Britain, the length of a foot is twelve inches, or .3048 of a meter (see METRIC SYSTEM). The foot of twelve inches was adopted in England in the reign of Henry I, the length of whose arm was declared to be the standard length of one yard. The foot was then made one-third of a yard.

In arithmetic, the *square foot* is a unit of measure in square or surface measurement. This unit is equivalent to a square, each of whose sides is one foot long. It therefore contains 12×12, or 144, square inches. In measuring solids, a *cubic foot* is a unit of measure. This is equivalent to a cube one foot high, one foot wide and one foot in breadth (see CUBE). It contains 12×12×12, or 1728, cubic inches. The *board foot,* a unit of measure for logs and lumber, is a board one foot square and one inch thick; therefore a board 12 feet long, 1 foot wide and 2 inches thick contains 24 board feet. See SQUARE MEASURE; CUBIC MEASURE.

FOOT, that portion of the skeleton of man and other vertebrate (back-boned) animals which forms the termination of the legs. In regard to structure, the foot bears a close



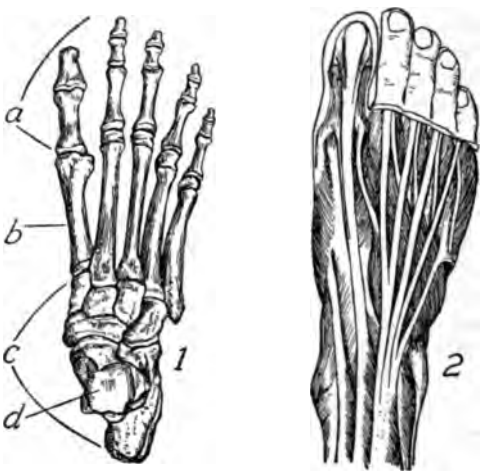
THE ORIGIN OF THE FOOT AS A STANDARD OF LINEAR MEASURE

resemblance to the hand, but its bones are larger and stronger and at the same time less flexible than those of the hand. The skeleton of the foot consists of seven rounded *tarsal* bones, which lie below the ankle joint and form the instep; five slender *metatarsal* bones, which form the ball of the foot, and fourteen *phalanges,* found in the toes. There are two phalanges in the great toe of each foot and three in each of the other toes.

The foot bones in man are so arranged as to form an elastic arch, which reaches from the rear end of the heel to the front ends of the tarsal bones. In walking, the arch bears upon the ground only at the heel and ball of the foot, and it is admirably adapted to breaking the jars which would be transmitted to the spinal column were the foot not provided with this natural, elastic spring. The arched instep is one of the characteristics which distinguish man from the beasts. Nearly all of the lower animals walk upon the tips of their toes, and even those which rest the heel on the ground in walking, as the bears, have only a slightly-developed arch. A high arch is considered a sign of beauty in the human foot, and it per-

forms an important service in making the gait easy and graceful.

In the act of walking, the foot, as it receives the weight of the body, broadens a little and



THE FOOT

(*a*) Phalanges (*c*) Tarsals
(*b*) Metatarsals (*d*) Astragalus

In the second illustration the white lines indicate extensor muscles.

also lengthens, perhaps a half-inch. The practice of wearing tight shoes, which interfere with this natural expansion, is therefore unhygienic. The discomfort occasioned by shoes that pinch the feet is well known. Unsightly and painful bunions on the side joint are caused by wearing shoes that are too short; when the toes are crowded against each other in too-narrow shoes corns and ingrowing toenails result. Broad, low heels that furnish a firm support should be chosen in preference to high heels that throw the feet forward toward the ends of the shoes, and tend to flatten down the arch of the foot.

It is interesting to compare the powers of the human hand and foot. The toes, except in special instances, are quite inferior to the fingers in flexibility and dexterity, because they are not called upon to perform such a variety of movements. This difference is especially noticeable in the case of the thumb and great toe. With the thumb we can touch each of the fingers with perfect ease, but the great toe can be moved only a little way in each direction. Savages who have never worn shoes, and apes, whose four limbs are about equally exercised, differ from civilized man in having a more flexible great toe.

The toes can be educated to perform some acts ordinarily performed by the fingers. Many persons born without hands or deprived of them by accident have learned to write, paint and carry on many other activities with their feet. S.C.B.

FOOT AND MOUTH DISEASE, a contagious and rapidly-spreading fever occurring chiefly in cattle, sheep and pigs, but which may be contracted by human beings. It is characterized by blisters, which first break out in the mouth but later may appear on the feet. It first occurred in England in 1839, and did not appear in America until 1870.

No certain microbe has been found which causes it, but it is known to be brought about by direct contact, infected feed, contaminated stables and even by birds carrying the disease to considerable distances. Probably it is most commonly contracted through the mouth by eating contaminated hay as feed and by feeding in pastures where cattle already sick have been kept.

The disease breaks out somewhat mysteriously, not following any certain rule or limiting itself to any one locality or country. Thus outbreaks occurred in 1880 and 1884, followed by complete disappearance until 1902. Then again it was stamped out and was not heard of after that until 1908, when an outbreak occurred in Michigan and spread to New York, Pennsylvania and Maryland. By that year the "scourge of Europe," as it was called, was looked upon as a serious affair; therefore the government and states involved ordered all infected herds bought, killed and buried in quicklime, and the locations were quarantined for three months afterwards. These measures were successful. In 1914 the disease reappeared, involving twenty-two states and the District of Columbia, but within a year all were free from it except Illinois, where it persisted a year longer. The method employed was to kill, bury in lime, and to quarantine; this has cost thousands and thousands of dollars, but it is considered by experts better than halfway measures, which, because they do not eradicate the disease, would eventually cost millions of dollars in losses of stock.

Symptoms. The period of incubation is usually from three days to one week. The early symptoms are smacking of the lips and drooling, preceded by fever. The animal shows a disinclination to move and when in motion walks "stiff." In about two days the characteristic blisters can be seen in the mouth, on the inner side of the lips and on the edges and tip of the tongue. The animal drops saliva

from the mouth. The smacking of the lips at this stage can be heard at a distance. The blisters rupture in two or three days and leave an ulcer, which may heal quickly or very slowly.

Soon the animal begins to be lame, drawing up one foot to ease the pain. The characteristic blisters are then seen on the skin above the hoof, and later the hoof may separate in places. The teats of cows are often broken out in blisters. In the malignant form of the disease death occurs very suddenly, and as high as fifty per cent of such cases are fatal. The death rate in ordinary cases is from two to five per cent.

Treatment. This may be considered under two heads, the *preventive* and the *medicinal.*

Preventive treatment consists in carefully isolating all well animals to keep them from coming in contact with the disease, and then thoroughly disinfecting the sheds, pens, etc., in which the stock has been kept. The contaminated feed, litter, etc., should all be burned or buried, following which the premises should be quarantined for three months. The infected stock and all other animals which have been exposed and may contract the disease should be killed and buried in quicklime; experts make no exception to this ruling.

Medicinal treatment consists in thorough cleanliness of the premises, soft food like gruel, and mashes. Chlorate of potash or nitrate of potash may be given in the drinking water and mild astringent applications made to the hoofs.

Danger to People. Man may contract the disease from drinking milk from infected cows, or getting the saliva in a raw place on the hands, as when milking, particularly on the fingers and at the roots of the nails. Young children are especially liable to take the disease and may die as a result. The outcome in adults is usually favorable. The milk from infected cows should be destroyed and attendants should be very careful to wash their hands in antiseptic solution, cauterising with carbolic acid any cut or raw places. J.R.M.

Consult Melvin's *The 1908 Outbreak of Foot and Mouth Disease in the United States,* in the annual report (1908) of the Bureau of Animal Industry, Washington, D. C.; also *Circular No. 141,* United States Department of Agriculture, Bureau of Animal Industry.

FOOTBALL, next to baseball the most popular athletic game in the world, is played principally in the British Empire and in the United States. It is a very ancient form of exercise and amusement. The Indians of North America and the aborigines of many of the Pacific islands played a similar game, and it is not at all improbable that football, in some form, was known in the far-off days when all Europe was in barbarism. The Greeks seem to have taught it to the Romans, and the latter, through their soldiers, to the Britons and other races of the north. In the British Isles football was played in the Middle Ages by whole communities, who kicked the ball without clear design through the streets or over the meadows, in such a rough fashion that the game was sometimes forbidden by statute. [illegible] nineteenth century did it become an organized game, with fixed numbers on each side and definite methods of counting score. Weight, physical fitness and endurance are prime requisites in players, but quick thinking is vitally necessary.

It was at the great English schools like Rugby, Harrow and Eton that football was first made practical. The boys' playground at Rugby was large, and there was plenty of room for running and tackling. At other schools, even as late as 1850, the game was confined to kicking and bunting the ball. Thus two distinct types of football have developed: *Rugby,* which permits running with the ball, and *Association* or *Soccer,* which prohibits it. The former includes English, Canadian and American Rugby, three distinct styles of play. The variations in these plays is made clear in the paragraphs that follow.

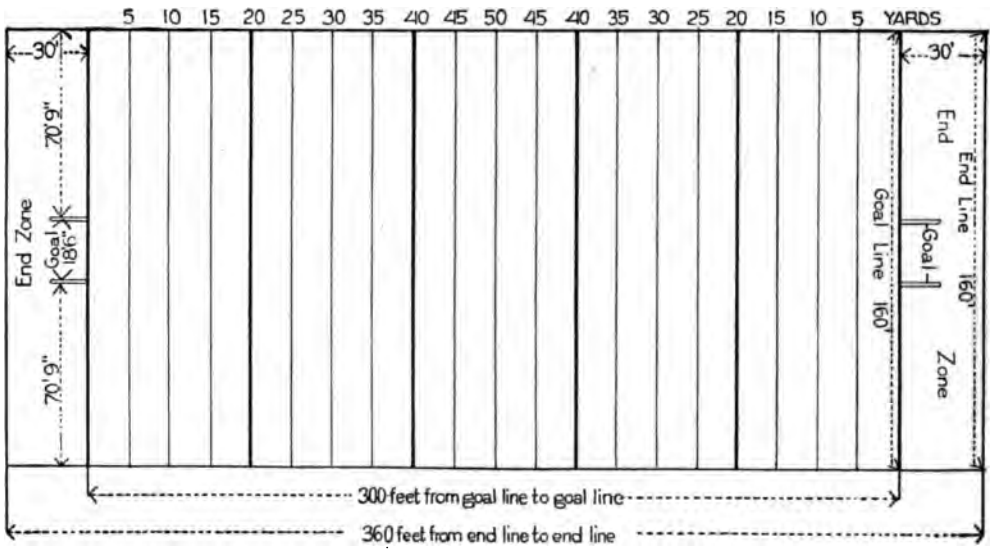
Football in the United States

The name *American Rugby* sounds strange to football players in the United States, but it is the correct name for their game. The early Virginia colonists brought the older English game to America, and soon after 1830 students at several of the eastern colleges began to play it. Ten years later, at Amherst, Brown, Harvard, Trinity and Yale, there were interclass games resembling the class rushes which still take place in some colleges, and so rough did they become that in 1860 the faculties of Harvard and Yale prohibited football. At Princeton a more orderly game was played, adapted from the English "Association" code, and in 1869 the first intercollegiate contest took place between Princeton and Rutgers. In 1871 football was revived at Harvard, with rules which permitted running with the ball, as in Rugby; two years later Harvard's team refused to join the association formed by Yale, Columbia, Princeton and Rutgers because its players would not abandon the Rugby style of play.

Not long after this, McGill College in Montreal challenged Harvard to a match, and on May 15, 1874, these two teams played the first intercollegiate Rugby match in America. McGill's players were accustomed to English Rugby rules and Harvard's to their own version of them, so on the preceding day the two teams courteously coached each other in tactics. On the 15th a match was played under Harvard rules, and Harvard scored three times. The next day, under McGill rules, neither side was able to score. The success of these two contests aroused enthusiasm for Rugby, and in 1875 Harvard and Yale played a game under a compromise set of rules which admitted both of running with the ball and of batting the ball with the hand. This compromise was unsatisfactory, and in 1876 Columbia, Princeton and Yale abandoned the other form of football in favor of straight Rugby.

Like all the more popular athletic competitions of the colleges of the United States, football has become a highly-specialized activity. The original Rugby rules have been entirely superseded by a gradual development of a code much more complex but permitting a far higher development of team play. Players are trained by professional coachers who in some cases receive several thousand dollars for a season's work. Each man is drilled in the elements of the game by long hours of practice in tackling dummies and charging against wooden frames. Team work is taught in scrimmages, the sham battles of football, and strategy is studied by blackboard talks. Though the game is played only in the autumn, the more ambitious colleges have practice in the spring as well.

As a result of all this care, a football game between two great colleges is one of the most interesting and exciting spectacles anywhere



THE "GRIDIRON," ON WHICH FOOTBALL IS PLAYED IN THE UNITED STATES

to be seen. The famous contests between Harvard and Yale attract the largest crowds, which seem to be limited only by the seating capacity of the Harvard Stadium, which will accommodate 47,000 people, and of the great Yale Bowl, which seats over 70,000. A number of "gridiron battles" in both the East and Middle West are scarcely less popular. Football in the United States is largely confined to schools and colleges, *clubs* like those of Canada being quite unknown.

How Played in the United States. Why a Rugby field is called a *gridiron* is apparent at first sight of one. As shown in the accompanying diagram of the field in the United States, distinct lines, which on the field are white, mark the borders and cross from side to side every five yards. The *goals* are upright timbers joined ten feet above the ground by a crossbar.

Each team defends a goal and attempts to score by carrying the ball across its opponents' goal line anywhere between the edges of the field, or by kicking it from the ground over the bar. The ball is a leather casing about a foot long and seven inches in diameter, enclosing an inflated rubber bladder. There are eleven players on each side, seven of whom compose the *line,* and four the *back-field.*

At the opening of the game one team places the ball in the middle of its forty yard line (that is, forty yards from its own goal), and lines up along the same mark. The other team is distributed throughout its half of the field. One member of the first team *kicks off* towards the opponent's goal, but does not necessarily attempt to kick the ball over it, as at this time no score would be counted. The opponent who catches the ball runs forward with it, dodging back and forth to avoid the onrushing men of the first team, and following two or three of his teammates, who form *interference* (protection) for him. He is usually *tackled* and thrown to the ground or stopped before he has reached the center of the field, but now and then a clever runner makes his way through the whole opposing team and reaches its goal. As soon as he is stopped the referee blows his whistle and the teams line up for the first *scrimmage.*

Scrimmage. The team in possession of the ball is now given four opportunities to advance it ten yards. The player called the *center* puts his hands on the ball, which rests on the ground with its points toward the ends of the field, and prepares to pass it backwards between his legs. To his right are the right *guard,* the right *tackle,* and the right *end;* to his left are the corresponding members of the left side of the line. Behind him are the *quarter-back,* the left and right *half-backs* and the *full-back.* The quarter-back is the directing general; upon his strategy and good judgment largely depends the success of the team. The instant the ball is *down* he begins to call secret signals, a rapid succession of numbers, and then he stands close to the center to receive the ball as the latter passes it, and to give it to the player who, in response to his signal, is to run with it. The line men of the opposing team are lined up behind the other end of the ball, the back-field men forming a secondary defense behind them.

Play commences the moment the center snaps the ball. If the signal has been for a plunge through the opposing line, it is the duty of some of the line men to spread apart their opponents and make a hole through which the runner may pass, and of the others to hold back the players opposite them. The back-field men assist the runner in various ways. But no player of the attacking side except the runner is allowed to use his hands or arms upon an opponent or those who are attempting to tackle him. The players on the defense may use their hands and arms to break through in an endeavor to reach the ball or the man carrying it. If instead of a line plunge the play is a run around the end, the whole offensive line aims to hem in their opponents so that they can neither stop the runner from in front nor reach him from the rear. The usual gain from a line plunge or an end run is only a few yards, if the teams are evenly matched, but sometimes a runner succeeds in going a long distance before he is tackled. On the other hand, if the offensive line is less alert than the defenders, the ball may be downed farther back than before.

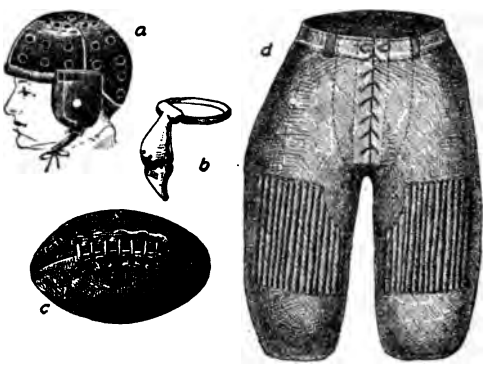
The Forward Pass. Though it has always been one of the principles of Rugby football that the ball could be advanced only by running or kicking, the forward pass has recently been introduced into the American game to add interest to the spectacle and to lessen the strain on the players from continued playing at close quarters. It is difficult to execute. The quarter-back, or any man behind the line, standing five yards back of the line, receives the ball from the center and throws it to one of his men who has run to a point where he can catch it and get away without being

tackled. The only men eligible to receive this forward pass are the two men on the end of the line or a man in the back-field who was at least one yard back of the line when the ball was put in play. Sometimes a forward pass results in a long gain; at other times an opponent catches it and dashes off down the field; or, again, the ball may fall to the ground untouched and be brought back by the referee to the point where the play started, one of the team's four chances to advance having been wasted.

Punt. A ball dropped from a player's hands and kicked before it touches the ground is said to be *punted.* If a team fails to gain its ten yards in the four tries permitted, the ball will pass to its opponents. If, therefore, at the fourth *down* the quarter-back sees that his men may fail to advance the necessary distance, and they are not near the others' goal, he may give the direction for a punt. The punter stands several yards back of his line men, so as to have plenty of time to kick. He sends the ball high in the air in order that the ends may run down under it and be at hand to tackle the man who catches it. A good punter will advance the ball from forty to sixty yards, but unless the opponents fumble it, possession of it passes to their team.

Scoring. If a team can put the ball down on or behind the other's goal line, it scores a *touchdown,* and earns six points. The ball is then brought straight out, or punted out to a point in front of the goal posts, and placed on the ground. Here one player holds it for another to kick, and if it passes over the crossbar another point is added to the score.

When a touchdown seems improbable, a team in its opponent's territory may attempt a *field goal,* which counts three points. This may be any kind of a kick except a punt. It is usually either a *place-kick,* similar to the goal-kick after a touchdown, but necessarily more hurried and therefore more difficult, or a *drop-kick,* in which the ball is dropped as in punting but kicked just as it touches the ground. In either case the ball must pass above the crossbar to score. A goal made from thirty-yards' distance is considered an excellent performance, but the record for a place-kick is sixty-five yards and for a drop-kick sixty-two yards. If a team carries or kicks the ball across its own goal line and is there downed, two points, called a *safety,* are scored against it. If, on the other hand, it downs a ball which its opponents have propelled or carried across, the result is a *touchback,* and no score is made. After either a touchback or safety the ball is given to the defending side on its twenty yard line, for a scrimmage.



USED IN THE GAME

(*a*) Headgear (*c*) Ball
(*b*) Nose guard (*d*) Trousers

Signals used by a quarter-back in directing his team are usually very simple. Sometimes each player has a secret number, and the signal 10-4-16-47-2 might mean that player number ten is to carry the ball through the hole prepared by player number four, the other numbers being without meaning. Or the numbers may refer to the play instead of the men, ten meaning that the full-back is to carry the ball around the left end, nine that he is to carry it around the right end. To

conceal the code the numbers which actually carry the message are usually preceded or followed by others. Thus it might be agreed that the third number should be the significant one. A starting signal is also sometimes used which indicates to the attacking side the instant the play is to start.

The officials of a football game in the United States are the *referee,* the *umpire,* the *linesman* and the *field judge.* Each has duties assigned by the intercollegiate rules. The first two are mainly concerned with the enforcement of the regulations, penalties for violating which are given by moving the ball a specified number of yards toward the goal which the side in error is defending.

The game, unless shortened by agreement, lasts an hour, and is divided into four periods of fifteen minutes each, with a one-minute intermission between the first and second and the third and fourth periods, and a fifteen-minute intermission between the second and third. Delays in the play are not counted as part of the game.

Canadian Rugby and English Rugby

In spite of the fact that English Rugby rules formed the basis for the game in both the United States and Canada, a visitor to either nation from the other finds football bewilderingly strange. Because of the differences in rules many details of good play in the one country would be poor policy in the other. Thus, when an American sees a Canadian kick the ball while running with it he is astonished, but no more than a Canadian who watches an American runner allow himself to be tackled with the ball instead of passing it to another of his team.

The Canadian Game. One of the principal points which distinguish the Canadian game is the rule forbidding *interference;* no player in front of the runner is allowed to protect him from tacklers. Another distinction is that *off-side* players, those who have been in front of the ball when it was kicked or thrown forward, must not come within three yards of an opposing player attempting to make a *free catch* of the ball, even if it has already bounded on the ground. The scrimmage line may consist of only three players, and the ball is put into play by *heeling off*—a backward kick with the heel. Fourteen men belong to each team.

Scoring is as follows: for a *try and goal,* six points; for a *try,* five; for a *drop-kick,* three; for a *drop-kick* or *place-kick* after a penalty, two; for a *safety-touch,* two; for a *rouge,* one. A try corresponds to a touchdown in American football. If a team is downed with the ball behind its own goal line, a safety-touch is counted against it if it has carried the ball there itself, a rouge if the other side has sent or carried it over the line. A rouge is also scored when a team secures the ball [illegible] twenty-five yards behind its opponents' goal or both behind the goal and the touchline (side line).

Penalties are awarded in various ways, including giving to the opponents the right to attempt a drop-kick or place-kick unhindered.

The Rugby championship in Canada is decided more definitely than in the United States, where it is always largely a matter of individual opinion. Both college and club teams are organized into leagues which play round-robins. At the end of the season the league winners meet for the national championship.

English Rugby. There is little difference between the original game of football and the Canadian game just described. Two features of it which have been abolished in both the United States and Canada are the old fashioned *scrummage* and the *throw-in.* The latter is used when the ball goes out of bounds at the side of the field. Instead of the ball being brought back to the field and put into play by a scrummage, it is thrown in between the two teams, each lined up at right angles to the side of the field. In a scrummage the *forwards,* eight of each team, gather around the ball and push each other with their heads. Each side endeavors to *heel* the ball into a position where its backs may seize and carry it. Neither side has definite possession of the ball as in the two American varieties of the game. There are fifteen men on an English team.

English Rugby is played principally for cups and for national and international championships. England, Scotland, Ireland and Wales meet each other every year, and since 1906 France, too, has figured in the international matches. New Zealand, South Africa and Australia develop teams which usually defeat those of the mother country, and during the War of the Nations there was interesting competition among the soldiers from various parts of the empire.

OUTLINE AND QUESTIONS ON FOOTBALL

Outline

I. History of the Game

(1) A very old game
(2) Development at the great English schools
(3) As played in the United States
  (a) Rugby
  (b) Association or soccer

II. Rugby Football

(1) The field
  (a) Size and shape
  (b) "Gridiron" markings
  (c) Goals
(2) The ball
  (a) Size
  (b) Shape and material
(3) As played in the United States
  (a) Players
    1. Number
    2. Position
    3. Duties
  (b) Officials
  (c) The course of the game
    1. The kick-off
    2. The scrimmage
    3. The forward pass
    4. Punting
    5. Signals
    6. Interference permitted
  (d) Scoring
(4) Differences in Canadian game
  (a) No interference
  (b) Free catch
  (c) Heeling off
  (d) Different method of scoring
  (e) Difference in number of players
(5) Rugby in England
  (a) Number of players
  (b) Differences in manner of play
    1. Scrummage
    2. Throw-in
(6) Widespread popularity

III. Association Football

(1) A faster game
(2) Running with the ball forbidden
(3) Differences in number of players, size of field and shape of ball
(4) Popularity in Great Britain and colonies

Questions

Why is the field on which the game is played called a "gridiron"?

If one side *downs* the ball behind its opponents' goal posts, and then succeeds in its free kick, what is its score?

In what kind of football do the sixteen forwards push each other with their heads? What is this play called?

When is the quarter-back most likely to order a *punt?*

What corresponds in Canadian football to a *touchdown* in the United States game?

What is the advantage of a forward pass? How is it made?

If you were watching a Rugby game, how could you tell from the attitude toward a player running with the ball whether the teams were from Canada or from the United States?

Was the first intercollegiate Rugby game in America a "domestic" or an "international" match?

What restrictions are there on "interference" in case of a line plunge?

Explain the terms *scrimmage; down; tackle; quarter-back.*

Whose duty is it to see that the rules are carried out and that players are penalized for breaking them?

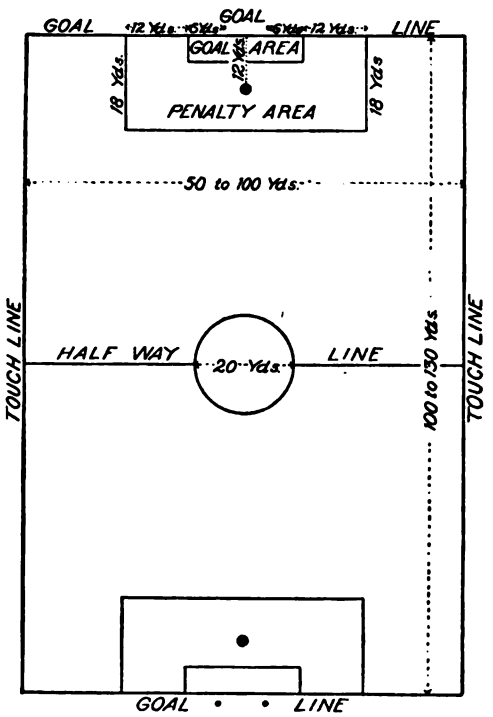
How could you tell an association football from a Rugby?

What is the chief difference between an association and a Rugby game?

Have you ever heard a player during a game call out some such series of numbers as 8-13-19-38-5-4? What is his object?

Association Football

Though perhaps giving both spectators and players fewer moments of tense-muscled suspense than Rugby, "soccer" football is a more lively, spirited and continuously active game. From beginning to end of its ninety minutes of play, interrupted only by the one minute rest at half-time, the ball travels back and forth and up and down the field, now pausing for a



ASSOCIATION FOOTBALL FIELD

moment as two players strive for its possession, then suddenly shooting through the air, now bounding from the head of a player who leaps into the air to intercept it by a bunt, now *dribbled,* or carried along in short kicks, by a player who seems as skilful with his feet as most people are with their hands; suddenly passed to another player by a kick with the side of the foot and driven swiftly toward the net which is stretched between the goal posts; then seized by the goal keeper after a headlong dive and punted quickly to midfield, where the [illegible], suspended only for a moment, begins

[illegible]ion football is so named because it [illegible]m of game for which the first set of rules was drafted, by the London Association, in 1863. "Soccer" is the word association converted into slang in the British fashion by adding *-er* to the principal syllable. Similarly, "rugger" stands for Rugby.

The popularity of soccer in Great Britain rivals (if it does not exceed) that of baseball in the United States. In normal times there are over 400 professional and 15,000 amateur clubs in the British Isles, and closely-packed, standing crowds of more than 100,000 witness some of the championship matches. There are a number of leagues, which play throughout the winter. On the continent of Europe, too, association football is a familiar game, and before the War of the Nations there was an international federation which included Austria, Belgium, Denmark, England, Finland, France, Germany, Hungary, Italy, Netherlands, Norway, Sweden and Switzerland. Quite naturally the British dominions and colonies also play the game, and it is growing in favor in the United States. In some parts of Canada it is more popular than Rugby.

Association football is played with a spherical ball about twenty-eight inches in circumference, on a field from 100 to 130 yards long and from 50 to 100 yards wide. Eleven players make up a team. The distinguishing principle of the rules is that the ball must never be touched with the hand or arm except by the goal keeper. See the general article ATHLETICS. W.C.

Consult Camp's *Book of Football;* Yost's *Football for Player and Spectator.*

FOOTE, ANDREW HULL (1806-1863), an American officer who was distinguished as a Federal naval commander, was born in New Haven, Conn. He entered the navy as acting midshipman in 1822, and later was executive officer in the Boston and Brooklyn navy yards. From 1849 to 1851, as commander of the brig *Perry,* he cruised along the African coast for the protection of American commerce and the suppression of the slave traffic. In 1852 he was advanced to the rank of commodore. In 1856, when in command of the China station, during the war between the Chinese and English, he was fired upon, by the former, and his demand for an apology being refused, he attacked and captured four of their forts.

In 1861, in the War of Secession, he directed the naval attacks on Forts Henry and Donelson, and was wounded in the engagement. In 1862, at his own request, he was formally detached from the western flotilla, became

chief of the bureau of equipment and recruiting, and in 1863 was appointed the successor of Rear-Admiral Dupont as commander of the fleet off Charleston. He died while on the way to assume the duties of his new position. A book written by him, entitled *Africa and the American Flag,* deals largely with his African cruise of 1849-1851.

FOOTE, ARTHUR (1853-), an American concert pianist and organist whose compositions have found their way into musical instruction all over America. He was born in Salem, Mass., and is typically American, having studied with the foremost American instructors.

The first of his compositions which won distinction was a *Trio in C Major* for piano and stringed instruments, composed in 1883, at which time he was giving a series of trio concerts. He has written extensively in all forms. Of his longer works, the best known are *Symphonic Prologue, Francesca da Rimini* and *Suite in E Major* for stringed orchestra. He has written musical settings for well-known poems, including Longfellow's *The Wreck of the Hesperus* and *Hiawatha* and five poems after Omar Khayyam. In addition to many pieces for the organ and for church choruses, he has almost a hundred songs to his credit, among them the famous *I'm Wearing Awa'; I Arise from Dreams of Thee; O My Love's Like a Red Red Rose,* and *In Picardie.* Foote's sincerity and genius have had an uplifting influence upon modern American music.

FOOTE, MARY HALLOCK (1847-), an American novelist and artist, born in Milton, N. Y. After her marriage to a mining engineer she lived for a number of years in Colorado, Idaho and California, and her novels, illustrated by herself, depict western types and scenery. Among them are *The Led Horse Claim, Coeur d'Alène, The Desert and the Sown.* She is also the author of many short stories.

FOOT-POUND. When a bundle of books is lifted from the floor to be placed on the shelves the resistance of the force of gravity must be overcome. In order to overcome it a certain amount of work is done, and this is in proportion to the weight of the books and the height of the shelves. Work therefore means the overcoming of resistance, and it necessitates the expenditure of energy. We can also define work as the action of force through distance. The amount of work to be done is determined by the magnitude of the force, or the weight of the object and the distance through which it acts. In the English system the unit employed to measure work is the *foot-pound.* The foot-pound is the amount of work done in order to raise a weight of one pound through a distance of one foot. In the metric system the unit of work is the gram-centimeter. The gram-centimeter is the work done in order to raise a weight of one gram through a distance of one centimeter.

FORBES-ROBERTSON, SIR JOHNSTON (1853-), one of the most distinguished actors of the day, born in London, England. Originally an artist, he turned to the stage when he was twenty-one and in time was a member of various leading companies, including that of Sir Henry Irving. In 1895 he appeared with Mrs. Patrick Campbell in *The Notorious Mrs. Ebbsmith,* and in *Romeo and Juliet,* in which he and Mrs. Campbell played the title rôles. His first appearance in America with his own company was in 1885 as Orlando in *As You Like It.* Later American successes include *Hamlet, Caesar and Cleopatra, Mice and Men, The Passing of the Third Floor Back* and *The Light That Failed.* He was knighted in 1913.

FORCE. When we throw a ball into the air it falls to the ground. We say that it is the pull of the earth, or the force of *gravity,* which causes its fall. When we catch a ball that has been thrown towards us we say that the force of our hands stops or destroys its motion. When a magnet attracts small pieces of iron we say that it is the magnetic force that has made the pieces of iron move towards it. In physics anything that produces, destroys or changes motion or tends to produce these effects is called a force. By long experience men have learned that the forces of nature always act in a uniform way—in other words, that in nature the same causes will always produce the same effects in similar circumstances. The object of physics and of other sciences is to discover the laws that govern the forces of nature, in order to be able to control them and to use them for our advantage.

Velocity and Acceleration. In physics a force is measured by the velocity it produces in a given mass in a definite portion of time, as for instance, in one pound of mass in one second. The rate at which a body moves is called *velocity,* and the increase of velocity in a given time is called *acceleration.* A body weighing ten pounds will require a force ten times greater than that necessary for a body

of one pound in order to produce upon it the same velocity. It is also evident that a greater force will be necessary in order to produce a still greater velocity or a greater change in motion. We express this by saying that the force required to accelerate any mass is proportional to the mass and to the acceleration produced, and that it is equal to the product of the mass by the acceleration produced. There are two systems for measuring force, the English system, which uses the poundal as the standard unit, and the metric system, which uses the dyne (which see). The laws of motion that govern bodies that fall to the earth are given in a separate article in these volumes (see FALLING BODIES). See also CENTRIFUGAL FORCE; CENTRIPETAL FORCE.

The *field* of a force is the area within which a force acts. Thus the field of force of the earth's gravity extends far beyond the distance to the moon, while the field of a body charged with electricity or of a magnet is limited to a small area around it. O.B.

FORCE BILLS, a name first applied to several bills passed by the United States Congress in 1833, but more recently given to the Lodge Bill to amend the election laws of the United States, and to provide for a more rigid enforcement of such laws. This bill passed the House of Representatives in July, 1890, but was defeated in the Senate. Force bills were so called because the power of the Federal government was forced upon a state in matters which affected the whole nation equally with the state.

During the process of reuniting the North and the South, known as the period of reconstruction, Congress passed a so-called force bill in May, 1870, which made punishable by fine or imprisonment any attempt to bribe or hinder qualified voters from casting their votes at the polls. In 1871 another bill known by this name was aimed against the Ku-Klux Klan, a Southern secret society of nearly half a million members.

The force bill from which the original term was derived related to the question whether a state's rights were subordinate to national rights, and was brought to a head by the action of South Carolina. A new protective tariff law was passed by Congress in 1832 which did not please the South Carolinians, and they declared in convention that the tariff law was of no effect in that state, and threatened to leave the Union if force were used to [illegible]t duties on foreign goods coming into the state. The bill passed by Congress aimed to enforce this law, as South Carolina had previously passed a resolution of nullification (which see).

FORD, HENRY (1863-), an American inventor and manufacturer, without doubt the best-known automobile manufacturer in the world. He was born in Greenfield, Mich., attended the district school, and later became a machinist in Detroit. About 1890 he began to experiment with steam carriages, and in 1895, after two years of work, he completed his first gasoline automobile. The Ford Motor Company, which he organized in 1903, became under his presidency the largest maker of automobiles in the world. By standardizing the output to a very simple design it was possible to reduce the price of Ford automobiles to such a point that their sales in 1917 were over 2,000 a day. In the month of March, 1917, his factory made over 59,000 machines.

HENRY FORD

Early in 1914 Ford drew national attention to the prosperity of his company by announcing that henceforth it would share its profits with its employees, and that their share for the first year would be $10,000,000. At the same time the working day was reduced from nine to eight hours, and $5 a day was fixed as the minimum wage for every employee over twenty-one years old, regardless of his position. The total assets of the company increased from an original investment of $28,000 in 1903 to $20,000,000 in 1912 and nearly $100,000,000 in 1916.

In December, 1915, Ford won much notoriety by paying the expenses of a "peace trip" to Europe for about 150 men and women, including reporters, students and a few well-known peace advocates. The "Ford peace-party," as it was called, visited the Scandinavian countries in an effort to arouse neutral opinion to end the War of the Nations. A few of the delegates traveled as far as The Hague, but Ford himself was compelled by illness to return to the United States almost immediately after reaching Norway. The earnestness of Ford and many of the dele-

gates, and the folly of the cry, "We'll get the boys out of the trenches by Christmas" were ridiculed by the American press, and the "peace party" broke up after a few weeks. From the beginning the United States government had disavowed any connection with the Ford party, and the European nations at war gave it no official recognition.

In the Presidential campaign of 1916 Ford was mentioned as a possible candidate on the Republican ticket. He received the endorsement of the voters at the primaries in Michigan and Nebraska, but this endorsement was generally regarded as evidence of a desire to keep the United States at peace with the world rather than of a demand for Ford for President.

In March, 1917, Mr. Ford offered to turn over his entire plant to the Federal government, without profit to his company, in case of war with Germany.

FORD, PAUL LEICESTER (1865-1902), American historical writer and novelist, was born in Brooklyn, N. Y. His novels include *The Honorable Peter Stirling,* which deals with a young attorney's struggle for recognition, and is generally supposed to be based on the life of Grover Cleveland, and *Janice Meredith,* a novel of the American Revolutionary period. Among his historical writings are *The True George Washington; The Many-Sided Franklin,* and *The Writings of Thomas Jefferson.* In a dispute over financial matters Mr. Ford, who had been a cripple all his life, was shot and killed by his brother Malcom, who then committed suicide.

FOREORDINATION, *fore or dina' shun.* Certain Protestant sects have always believed that every event in the history of man is a direct result of the purposes of God—in other words, that every event is *foreordained* by Him. To deny Him such a part in human affairs, they declare, is to limit His knowledge and power. Calvin based much of his theology on the doctrine of foreordination, and the churches which followed his teachings for centuries laid great stress upon it. The result in many instances was a very gloomy form of Christianity, for the original doctrine was distorted until it declared that God ordained certain people to be lost, just as He ordained certain others to be saved. Such interpretations of the doctrine went far beyond the intention of the theologians, who based their views of foreordination on the goodness of God, and believed that He "foreordained" to be lost only those whom He could by no means win to righteousness. In recent years less emphasis has been laid on foreordination.

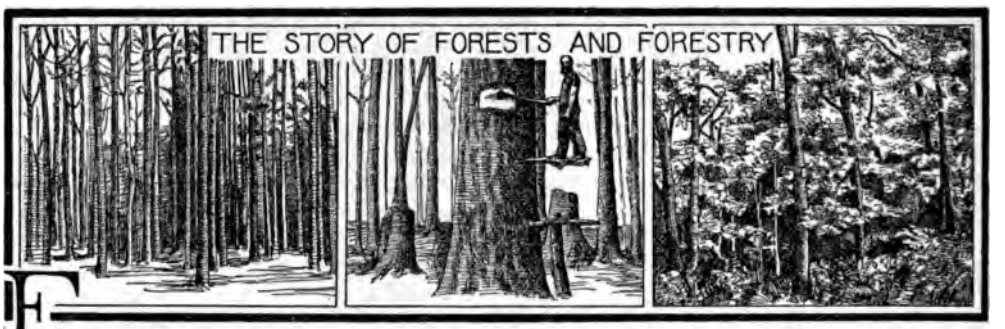
FORESHORT'ENING, in drawing and painting, is the art of representing objects on a plane surface as they appear to the eye, depending upon an accurate knowledge of form, perspective, and the treatment of light and shade. The figures thus represented convey the impression of the entire length of any object, although only a part of this length actually is shown. An object viewed in an oblique direction is foreshortened. In drawing an object in such a position, less space would be covered than if the object stood straight in front of and on a level with the observer.

Foreshortening is one of the most difficult studies in the art of painting. Michelangelo, Rubens and Correggio were distinguished for their skill in foreshortening; each practiced modeling as an aid in attaining this art. See INDUSTRIAL ART.

FOR'ESTERS, ANCIENT ORDER OF, a fraternal organization founded in Yorkshire, England, in 1745, and introduced into America in 1832 by the establishment of a court in Philadelphia. In 1917 there were in the United States three high courts and 441 subordinate courts, with a membership of nearly 50,000. Its entire membership is about 1,600,000. Funds are raised by fixed dues, and annual disbursements in benefits to families of members amount to over $5,000,000. There is a flourishing Canadian branch.

FORESTERS, INDEPENDENT ORDER OF, a fraternal and benevolent society, with branches in Canada, Great Britain, Norway, France, India and Australia. It was founded in Newark, N. J., in 1874, and reorganized in 1881. There were in the United States in 1917 fifty-five high courts and 4,150 subordinate courts, with a membership of 218,074. The total disbursements of the order since its organization amount to over $45,000,000, with annual benefits to families of members of about $3,900,000.

FORESTERS OF AMERICA, a benevolent and fraternal association which was originally part of the Ancient Order of Foresters. It was founded in England in 1745, and introduced in the United States in 1832. In 1839 the American order became a separate and distinct organization entirely within the United States. In 1917 it had eighteen grand courts and 1,550 sub-courts, with a membership of over 205,000. Since its organization over $44,000,000 has been disbursed in benefits.



FORESTS AND FORESTRY. The use of the word *forest* to describe a heavily wooded tract of land is so common that it seems strange to think that it did not always have that meaning. In earlier years in England a forest did not necessarily have any trees—it was just a stretch of land of any sort, pasture land or even village land, which was set apart for hunting, and usually belonged to the king.

Kinds of Forests. The name *forest* is from the Latin *foris,* meaning *out-of-doors,* and once upon a time, in far bygone ages, the name would have been very suitable, for all out-of-doors was almost literally covered with trees. There were bleak mountain tops, it is true, and also far polar regions where the climate was too cold to allow any vegetation to grow, but all between was forest land. Each zone, then, must have had its own particular kind of trees, and to-day, in the forests which remain, the same differences of type are noticed. Soil and climate are the great factors in determining not only whether land shall be grassland or forest, but in determining what kind of forests shall grow in certain localities. And of climate conditions moisture is by far the most important. Given a sufficient rainfall, no matter how this may be distributed throughout the year, a forest will grow; and only in regions of very heavy rainfall are such dense, luxuriant forests as those of the Amazon country possible.

Of the various kinds of forests, there are three which are most important to people in temperate zones. In the cooler regions are to be found those huge groves of cone-bearers, which the scientist calls *conifers*—the pines, spruces, firs and hemlocks which are so dominant a feature of the Northern United States and Canada. Growing among them, and lighting up in the autumn with their marvelous tints the gloom of the evergreen shade, are frequently to be found beech, birch and maple trees in profusion.

In the warmer temperate regions flourish the familiar "woods" of oak, maple, beech, chestnut and other hardwood trees, nowhere to be found in more typical form than in the Eastern United States and Southern Canada. These are all *deciduous* trees—that is, they shed their leaves at the approach of winter; for only in their naked, leafless state can the trees present to the dry winter winds an evaporation surface sufficiently small to enable them to live.

The third type of temperate-region forest is not so widespread as these two, but is found in abundance in coastal regions. It, too, is made up of evergreen trees, but its evergreens have not the narrow, needle-like leaves of the cone-bearers. Some of the forests of California, with their madroñas and strawberry trees, illustrate this type.

Where Forests Grow To-day. Of its original forest growth every continent still possesses large tracts, and almost every country in the world has some forest never touched by the hand of man. The heaviest forests are found in South America, along the Amazon, where the jungle with its undergrowth and its climbing, intertwining vines is so dense that passage through it is impossible. Africa has a forest area almost as rich, but nothing like these two areas exists in any of the more thoroughly explored continents. Of the countries of Europe and North America, Canada has the largest forest area—over 600,000,000 acres; but Sweden, with 50,000,000 acres, has the largest proportion of its surface under trees—forty-eight per cent. The United States has 550,000,000 acres of forest land, or about twenty-five per cent of its total area. Great Britain, with 3,000,000 acres of woodland, has the smallest proportionate amount of any important country—only four per cent—but Switzerland has a smaller actual amount—2,000,000 acres.

The Deforesting of Land. The first comers to most lands have found them forested.

The woods against a stormy sky
Their giant branches tossed,

says the familiar poem that tells of the landing of the Pilgrims in North America. And to make themselves houses, to fit the land for agriculture, they had to cut down the forests. Then, too, extensive woodlands near new and feeble settlements have always been a source of danger, so easily might animals or savage enemies lurk in their shadows. There were other reasons, too, for cutting down forests—economic ones—because wood was needed for fuel, for furniture, for ships, for almost numberless things; and new uses constantly developed. In addition to all this, in every wooded region which has been settled inestimable quantities of wood have been wasted—burned just to get it out of the way; and the time came in the history of almost every nation when it became evident that sooner or later, if the original policy were persisted in, there would be a sad lack of forest areas.

Value of Forests. Wherein lies the great value of forests? Some points are so obvious that they scarce need mention—the fuel and lumber aspects, for instance, and the use of wood for a thousand other things. But if there were no wood to be had its place could now be taken fairly well by other substances. Concrete is being used increasingly in building; the newest and finest ships and railway cars are of steel; coal, gas and electricity offer solutions of the fuel problem.

The utility of forests is not confined to their value as logs or lumber after they are cut down; it is just as great when the trees remain rooted in the soil. Everyone recognizes the beauty of forests, every variety having its special charm; and everyone realizes the protection which the sheltering trees give to flowers, to birds and to other animals. The economic value, however, is not evident on the surface, and for that reason men did not discover it for a long time—in some instances until it was too late to remedy the damage done.

First of all, forests prevent rapid evaporation, and so tend to equalize moisture. In perfectly open country the streams carry off the water as soon as it falls, but in forest country the heavy mat of dead leaves and underbrush holds it and allows it to flow off gradually. The streams which have no forests near their sources and near the sources of their tributaries are certain to be of the type which dries up, wholly or partly, during the seasons of no rainfall, but in the rainy season is subject to sudden floods. Years ago, before all this was understood, the trees were cut from about the mountain sources of certain rivers of Southern France, and now the spring freshets work great damage each year.

Related to this is the part forests play in preventing erosion by lessening the rapidity of streams—a work of great importance when it is considered that in various parts of the world millions of acres of once valuable agricultural land have been literally eaten away by rushing rivers (see EROSION). Then, too, trees are a protection against wind, and also do the farmer a real service by housing the birds which are among his best friends because they help to protect his crops from insect enemies.

As stated above, almost every country in the world at some stage of its history has come to realize that it was wasting its forest wealth, and first one and then another made more or less formal and effective plans for forest preservation. Gradually there was evolved a regular science of the growth and management of trees—a science which received the name of *forestry*.

Forestry

Aims and Methods. Though its object, broadly stated, is very definite—to care for forests and make the most of their products—the problem of forestry presents many difficulties. While it seeks to prevent the present generation from despoiling the future of that which is its right, it must avoid the opposite error of saving for the future at the expense of present welfare. That is, it is not simply a matter of forest preservation. The government of a country could not simply decree that no trees were to be cut, and so solve the whole question, for trees must be cut constantly to meet imperative needs. But there should be other forests growing up to take the place of those which are being cut down, and the work undertaken by the forestry service in various countries includes the preservation of forests, the reforestation of areas which have been cut over, the planting of regions which have before been treeless, the prevention of forest fires, the setting aside of forest reserves and the reformation of wasteful methods of lumbering.

Forest creation is one of the most interesting phases of the work, and in it two main methods are employed. Such trees as oaks, birches, chestnuts, elms—most of those hardwood trees which lose their leaves in the fall—will grow *in coppice;* that is, when they have been cut they will send up shoots from the stumps, some of which shoots will reach, in the course of a generation, a fair size. The cone-bearing trees, however, and all others which do not sprout well, are grown from seed, either starting life in a nursery and being transplanted or growing from the first on the area set aside for them. Larger trees can be obtained from seeding than from coppicing.

In the United States. Scientists had realised for years that the United States was in a fair way to exhaust its forest resources, and occasional spasmodic laws were passed to prevent this; but not until 1891 did the country have anything like a national policy. In that year a law was passed authorizing the President to set aside forest areas as *national reserves,* while a change was made in the laws relating to the management of government timber land. The Division of Forestry, created in 1880 under the Department of Agriculture, and becoming of ever-increasing importance, was made, in 1901, the Bureau of Forestry, and in 1905 was reorganized as the *Forest Service,* with greatly enlarged powers. All the phases of forestry enumerated above the Service attends to, and in addition it gives assistance to individuals and to state governments in developing and protecting their forests. By no means the least of its achievements has been its successful campaign against forest fires, formerly a frightfully destructive agency; for it is estimated that since the settlement of the United States fire has destroyed more timber than has man; and this gigantic loss the Forest Service has practically eliminated.

National Reserves. These are not literally *reserves* in the sense of being withheld from use, but they are very carefully managed so that the greatest possible good will come from them. The privilege of cutting a certain number of trees within the reserve each year is usually leased to individuals, but the methods to be employed are clearly specified, and the trees which may be cut are designated by authorized forest rangers. At present there are in the United States over 160 national forests, with a total of 164,068,393 acres, most of this area being west of the Mississippi River. In very recent years considerable land has been acquired by the government in the White Mountains and the Southern Appalachians, the object being to prevent the deforestation of stream sources.

In Canada. Canada has at the head of its very efficient forestry service a Director of Forestry, who works under the Department of the Interior. His problems are similar to those of the Forest Service of the United States rather than to those of the foresters of Europe, for the forests of the two American countries are far vaster than those in Europe. Patroling the huge forest districts of the Dominion are rangers, who, like those of the United States, have sole right to designate the trees which may be cut and who with their subordinates have done remarkable work in preventing forest fires.

Under the Dominion government there are thirty-one national forests, the total area of which is 23,017,504 acres; more than half of this is in one great reserve, Rocky Mountains Forest Reserve, in the province of Alberta. But this total is far from representing all the public forest land in Canada, for several of the provinces control great reserves, those of Quebec having an area of 111,401,280 acres. All in all, there is a reserve area of 147,200,000 acres, or almost one-fourth of the total forest region of the country. A.MC C.

Consult Green's *Principles of American Forestry;* Roth's *First Book of Forestry.*

Related Subjects. The following articles in these volumes contain much information that will be of interest in connection with the above. The articles on the various important countries may also be consulted.

Climate	Rocky Mountains Forest Reserve
Conservation	Tree (see list)
Erosion	Yellowstone National Park
Glacier National Park	Yosemite National Park
Lumber	
Parks, National	

FORGERY, *for'jer i,* the act of making or altering in the slightest degree any written instrument, for the purpose of deceit or fraud. Before conviction can be secured an intent to defraud must be shown; it is not required that anyone should have been injured, but that the forged instrument may be hurtful or prejudicial is sufficient proof. The punishment of forgery is either fine or imprisonment. In the different states of the American Union and the Canadian provinces the penalty varies, the statutes in some cases having been enlarged to include acts which were not formerly punishable as forgery.

Forgery is most common in connection with signatures to important documents, and especially with respect to checks, whose amounts may be largely increased by skilful and unlawful work with a pen. In common speech this latter crime is known as "raising a check." See CRIME.

FORGET-ME-NOT, the dainty, meek flower of an herb common in the United States, Southeastern Canada and England. Some species grow in ditches and damp meadows; others are found only in dry places. For most successful cultivation a cool, moist soil is best. The species most often seen has lancelike, downy leaves on a weak stem, with loose clusters of small, five-petaled, sky-blue flowers with yellow eyes. The flower buds are pink.

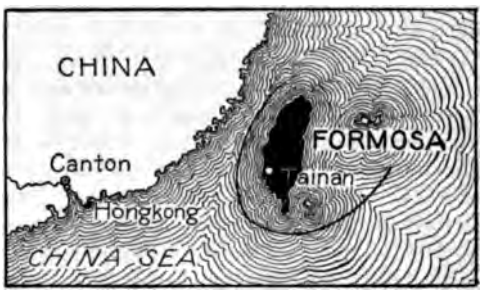
The sweet forget-me-nots,
That grow for happy lovers.
—TENNYSON: *The Brook.*

One species cultivated in greenhouses and valued for its brilliancy is the dark-blue forget-me-not of the Azores. Another species, with short, soft leaves, gave this genus of plants the Greek name *Mtosotis,* meaning *mouse-ear.* In England the forget-me-not is sometimes called *scorpion grass,* but in many languages the name of this plant is the same—forget-me-not.

In the language of flowers, the forget-me-not stands for remembrance, and it is a symbol of friendship, the world over. In Longfellow's *Evangeline* he speaks of the stars as "the forget-me-nots of the angels." It is a favorite flower with painters. See FLOWERS.

FORMALDEHYDE, *fawr mal' de hide,* a compound of carbon, hydrogen and oxygen, discovered by A. W. Hoffman in 1867. It may be obtained in several ways; one popular method is by leading a mixture of vapor of methyl-alcohol and air over a heated platinum spiral. The solution is the commercial *formalin.* The chemically pure article is unknown. Formaldehyde is a powerful disinfectant, and it is used also in the manufacture of certain dyes.

FORMOSA, *fawr mo'sa,* called TAINAN by the Japanese, who took it from China, is an island in the Chinese Sea, separated from the mainland of China by a strait about ninety miles wide in its narrowest part. It covers an area of 13,429 square miles, and is therefore



FORMOSA
The curved line separating the island from the mainland marks Japan's line of ownership.

larger than Maryland. The island is noted for the majestic beauty of its scenery, to which it owes the name *Formosa the Beautiful,* given to it by early Spanish navigators.

The soil is extremely fertile, and cereals are produced in abundance, but tea is the most important product. Much of the tea imported into the United States and Canada comes from Formosa, those two countries taking practically all of the island's crop. This was formerly shipped to Chinese ports, where it was repacked and forwarded, but now there is direct communication between Formosan ports and North America. Corn, sugar, pepper, camphor, indigo, hemp and timber are also exported, the principal trade being with China, Great Britain and the United States. The inhabitants are for the most part of Chinese and Malay descent, but there are still numbers of aboriginal savage tribes inhabiting the interior.

The chief town is Tainan, but more than seventy-five per cent of the commerce passes through Tamsui, the port at the mouth of the Tamsui-yei River. Formosa was ceded to Japan in 1895 after China's defeat in the Chinese-Japanese War (which see), and is administered by a governor, who is subject to the imperial authority of Japan. Population officially estimated in 1913, 3,512,607.

FORMS OF ADDRESS'. See ADDRESS, FORMS OF.

FOR'REST, EDWIN (1806-1872), a famous American actor who honored his profession in life, and upon his death left a large portion of his ample estate to found a home for aged and destitute men and women of the stage. He was born in Philadelphia, where, in 1820, he made his initial appearance in the title rôle

of Home's *Douglas*. His first real triumph was in 1826 in *Othello*. In 1836 he appeared in London as Spartacus in *The Gladiator*. Other notable rôles include Virginius, Damon and Lear. His last professional appearance was in 1871.

FORT. See FORTIFICATION.

FORT COLLINS, COLO., the county seat of Larimer County, is in the northern part of the state, on the Cache la Poudre River and on the Union Pacific and the Colorado & Southern railroads. The population in 1910 was 8,210; in 1916 it was 11,451. Fort Collins occupies an area of over two square miles, on a sandy plain near foothills of the Rocky Mountains. It is the seat of the state agricultural college, in connection with which is a government experiment station. The city has a Federal building, courthouse, Carnegie Library, hospital and parks. Sugar beets, potatoes, alfalfa and wheat are important crops of a large surrounding irrigated district, and the city has a large sugar-beet factory.

Fort Collins adopted the commission form of government in 1913.

FORT DEAR'BORN, a fort built in 1804 on the site of the present city of Chicago, and famous for the massacre which occurred there on August 15, 1812. On that day the garrison of sixty-seven men, commanded by Captain Heald, evacuated the fort under orders from General Hull from his headquarters in Detroit. Accompanied by thirty settlers, including women and children, and escorted by a band of Miami Indians, he started for Detroit. At a short distance from the fort (near the eastern end of the present Eighteenth Street), they were attacked by a large number of savages, who were joined by most of the escort. Two-thirds of their number were killed, and the rest were captured. The fort was destroyed by the Indians on the following day, was rebuilt about 1816 and razed in 1856. A monument marks the spot of the massacre; it stands about five hundred feet from Lake Michigan.

FORT DEARBORN

Fort Dearborn was named in honor of General Henry Dearborn, a prominent figure in [illegible] of 1812.

FORT DODGE, IOWA, the county seat of Webster County, is in the northwestern part of the state, eighty-five miles north and west of Des Moines and 135 miles east of Sioux City. It is on the Des Moines River and on the Illinois Central; the Minneapolis & Saint Louis; the Fort Dodge, Des Moines & Southern, and the Chicago Great Western railroads. A long steel railway bridge crosses the river at this point. The population was 15,543 in 1910 and 20,648 in 1916. The area of the city is nearly four square miles.

Fort Dodge is the seat of Tobin College. It has a Federal building, courthouse, Carnegie Library and Oleson and Reynold's parks. The city is a trade center for a rich farming country, and in the locality are an extensive gypsum bed and deposits of coal, glass sand, clay and brown sandstone. The wholesale trade is extensive. Railroad shops of all four roads entering the city are located here, and other establishments are greenhouses, boiler works and foundries, and manufactories of gypsum and clay products, brick and tile, plaster, oatmeal and shoes.

Settled in 1854 on the site of a fort built four years previously as a protection against the Indians, Fort Dodge was chartered as a city in 1869. In 1911 the commission form of government was adopted.

FORT DONELSON. See FORT HENRY AND FORT DONELSON.

FORT DUQUESNE, *du kane'*, a fort erected by the French in 1754 at the junction of the Allegheny and the Monongahela rivers, around which, in 1764, the city of Pittsburgh was laid out. It was an important French military station, was the objective of numerous attacks by the English, and was finally captured by them in 1758. At the suggestion of General Washington, its name was changed to Fort Pitt, in honor of William Pitt, prime minister of England. The old block house built by General Bouquet in 1763 still stands. See PITTSBURGH.

FORT FRANCES, *fran'ses*, the principal town of the Rainy River district, Ontario, a lumbering center and headquarters for hunters and fishermen. It is situated in the extreme western part of the province, on the north bank of Rainy River, which at this point is the boundary between Ontario and Minnesota. On the Minnesota side of the river is the town of International Falls. Fort Frances is 174 miles northwest of Duluth, 207 miles southeast of Winnipeg and 232 miles west of Port

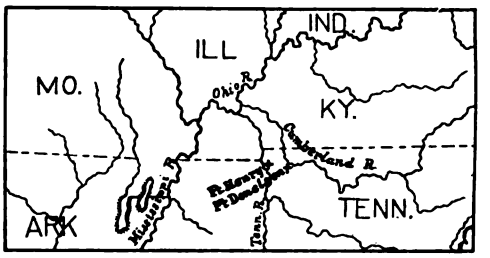
Arthur. It is on the main line of the Canadian Northern Railway, and at International Falls has connection, through the Minneapolis & International Railway, with the Northern Pacific and other railways in the United States. Fort Frances is the terminus of several steamship lines whose small vessels traverse Lake of the Woods, Rainy River and Rainy Lake, one-half mile east of the town. Large lumber mills, in which from 600 to 800 people are employed, pulp and paper mills and planing mills are the principal industrial establishments. Nearly all nationalities are represented in the population, which in 1910 was 1,611; in 1916 it was estimated at 2,000.

FORTH, a river and firth, or estuary, in the east of Scotland. The river is formed by the Duchray Water and the Avondhu River, which rise in the slopes of Ben Lomond in Stirlingshire and unite about a mile from the town of Aberfoyle. The actual length of the river is sixty-six miles, though the distance from its source direct to the sea is only about thirty miles. From the town of Kincardine to the North Sea, a distance of forty-eight miles, the river is known as the Firth of Forth, one of the finest natural harbors in the British Isles. It varies in width from one and a half miles at Kincardine to seventeen and a half miles at the mouth. The oyster beds for which the Firth of Forth was long noted are greatly diminished in value, but there are still many important fishing centers on both coasts.

Forth Bridge, a railway bridge one and a half miles long, crossing the Firth of Forth. It is built on the cantilever principle, and is regarded as one of the most remarkable bridges in the world. The actual length is 8,295 feet, over one and a half miles; it has two main spans of 1,710 feet, two arms of 680 feet, fifteen spans of 168 feet and seven small arches. The center of the bridge is 152 feet above high water, the extreme height of the towers being 361 feet. The bridge was completed in 1889 at a cost of $13,000,000.

FORT HENRY AND FORT DONELSON, two forts of the War of Secession in America, constructed by the Confederates in 1861 south of the boundary line between Kentucky and Tennessee. The former was located on the right bank of the Tennessee River, and the latter on the left bank of the Cumberland, the distance between the two being about twelve miles. They were important, for they controlled the entrance into Tennessee and the states farther south.

On February 6, 1862, a fleet of gunboats under Commodore Foote attacked and captured Fort Henry. Most of the Confederates escaped to Fort Donelson, which, thus reënforced, at first successfully withstood the attack of the land troops under General Grant, but



LOCATION OF FORTS HENRY AND DONELSON

later began to weaken. During the next night Generals Floyd, Pillow and Forrest, with 2,000 men, escaped, leaving the command to General Buckner, who, on the following day, recognizing the situation as hopeless, offered to surrender on certain conditions. These were rejected by General Grant in his now famous words, "No terms but unconditional and immediate surrender can be accepted." General Buckner then surrendered 15,000 men, and a large amount of ammunition and stores. This was the same General Buckner who, in 1896, was the candidate for President of the United States on the Gold Democratic ticket, as a party protest against the "free silver" candidacy of William Jennings Bryan.

FORTIFICATION, *for ti fy ka'shun,* a term applied to the art of strengthening military positions, and also to the earthworks, fort, fortress or other engineering device used for defense. Modern scientific fortification dates from the reign of Louis XIV of France (1638-1715), during which time the distinguished engineer, Vauban, devoted many years to the erection of permanent fortresses sufficiently strong to withstand the attacks of the most powerful artillery then known. The object of fortification is to give protection to troops so that they may, while themselves under cover, repel attacks of troops in superior numbers who must advance against them along comparatively open ground.

For military purposes fortifications may be classed as *permanent* or *temporary.* Permanent fortifications are erected to defend a town, harbor, arsenal or some particular point that may be an object of attack. In planning such fortification the nature of the surrounding ter-

ritory must be carefully considered. The defenses must be erected so that every approach is guarded, and planned in such a manner that the various parts of the fortification may be able to support each other by gun and rifle fire.

Temporary fortifications are prepared to afford protection to troops wherever they may be in war time. These consist chiefly of trenches, barbed wire entanglements, felled

QUICKLY-CONSTRUCTED TRENCHES

At top, typical lying-down trench, made under fire of the enemy. Second, a shallow trench, furnishing shelter for kneeling soldier. Third, a complete standing trench. At bottom, form of construction of cave shelter, which, though crude, possesses comfortable features. See other illustrations of trenches in article WAR OF THE NATIONS.

trees, and in fact anything available which will retard the advance of hostile troops. Modern warfare has proved that forts such as were erected by Vauban, consisting of huge earthworks, surrounded by a moat or ditch, and of late years greatly strengthened by steel and cement, cannot withstand present-day artillery. The forts of Liége and Antwerp, considered the strongest ever built, crumbled beneath the mighty shells of the German howitzers at the beginning of the War of the Nations, in 1914. Steel and cement are giving way to earth and sand, and fortresses, instead of standing out boldly are now being made as nearly invisible as possible. A fort, the range of which has been accurately ascertained, can withstand attack but a few hours, or a few days, at most. Forts in which big guns may be moved from place to place are more valuable than those in which the guns retain a more or less fixed position; an earthwork, consisting of hastily thrown-up mounds, behind which guns may be hidden, is then more effective than the strongest structure of steel and concrete that human ingenuity has yet erected.

Early in the War of the Nations it was found that the most satisfactory fortifications that could be constructed were series of trenches connected with each other by zigzag passages. In such trenches a few determined men could resist the assaults of far superior numbers, and only after severe bombardment by heavy guns could a successful advance against them be achieved.

Contrasting the quick reduction of the great fortifications in the War of the Nations with the long sieges required to destroy forts in former wars, it is possible to estimate the terrible energy of modern guns. Some historical data is given in the article SIEGE. See, also, WAR OF THE NATIONS.

FORT MADISON, IOWA, county seat of Lee County, is a city on the Mississippi River, in the southeastern corner of the state. It is nineteen miles south of Burlington and twenty-five miles north of Keokuk. Saint Louis is 202 miles down the river. Fort Madison is on the Atchison, Topeka & Santa Fe and the Chicago, Burlington & Quincy railroads and is a port for upper river and local packet steamers. The area of the city is nearly six square miles. The population in 1910 was 8,900; the state census of 1915 reported 9,507.

Since the completion of the power dam at Keokuk (see KEOKUK DAM), the development of Fort Madison, which is within the power zone, has been rapid and substantial. Since 1914, four large factories have located here, a new street railway has improved the local system, the city has granted new water and gas franchises and has appropriated large sums for paving streets, laying sewers, etc. The building of an interurban railway through a fertile and productive farming region to the old Mormon town of Nauvoo, ten miles south in Illinois, is one of the new projects to be undertaken.

Among the more prominent buildings are the Federal building, erected in 1913 at a cost of $75,000; the German-American bank building, erected in 1916 at a cost of $110,000; Cottermole Memorial library, and the Santa Fe and Sacred Heart hospitals. The state penitentiary is located here. There are four public parks. From the bluffs the views up and down the river are attractive. There is a fine railroad and wagon bridge across the Mississippi.

The industrial establishments are a packing house, shops of the Atchison, Topeka & Santa Fe Railroad, whose monthly pay roll is $70,000, grain elevators, brick works, cement-block works, foundries and machine shops, wrapping-paper mills and plow factories.

A stockade fort was built on the site of Fort Madison in 1805; in 1813 it was destroyed by fire. A permanent settlement was made in 1833; the town was chartered in 1836 and became a city in 1839. J.J.H.

FORT MIMS, MASSACRE OF, an Indian massacre on August 30, 1813, at Fort Mims, thirty-five miles north of Mobile, Ala. At the outbreak of the Creek War 553 men, women and children had assembled in the garrison for protection. They were attacked by a large band of savages and in spite of their brave resistance all but fifteen were killed.

FORT MONROE or **FOR'TRESS MONROE,** a fort on Old Point Comfort, at the mouth of the James River, Virginia, commanding the entrance to Hampton Roads. It is the headquarters of the coast defenses of Chesapeake Bay, and is the location of one of the largest military posts in the United States. It occupies a reservation of 282 acres ceded by Virginia in 1818 to the Federal government.

FORT MOULTRIE, *mohl'tri,* a fort on Sullivan Island, at the main entrance to Charleston Harbor, South Carolina, formerly known as Fort Sullivan. It was famous for its defense against the British in the Revolutionary War. In 1776 a force of English troops under Sir Henry Clinton and a fleet under Sir Peter Parker arrived at Charleston Harbor with the intention of occupying Charleston and operating from there against the Southern colonies. An American force of 6,500, under Colonel Moultrie, was stationed at Fort Sullivan, at the eastern end of Sullivan's Island, and successfully defended Charleston. The Southern states were thus temporarily freed from invasion. The name of the fort was subsequently changed to Fort Moultrie. On May 7, 1780, it was seized by the British. At the outbreak of the War of Secession it was occupied by a United States garrison, but fell into the hands of the Confederates when Major Anderson abandoned it for Fort Sumter in 1861. See FORT SUMTER.

FORT NIAG'ARA, a fort formerly at the mouth of the Niagara River, on the American side. La Salle built a rude structure here in 1669, and ten years later he constructed a fortified trading post on the same site. In 1725 the Frenchman, Vaudreuil, erected Fort Niagara, which soon became the most important military and trading center on the Great Lakes. In 1759 it was attacked and captured by the British under Sir William Johnson, but was returned to the Americans in 1796, in accordance with the treaty of 1783. In 1813 it was attacked and captured by the British, and again given back to the Americans at the close of the War of 1812. In 1826 it had ceased to be important as a military center, and the United States troops were withdrawn. Later it was demolished.

FORT SCOTT, KAN., the county seat of Bourbon County, in the southeastern part of the state, is five miles west of the Missouri state line and ninety-seven miles south of Kansas City. It is on the Marmaton River, and on the Saint Louis & Kansas City; the Missouri, Kansas & Texas and the Missouri Pacific railroads. The area is four square miles. In 1910 the population was 10,463; in 1916 a Federal estimate gave 10,550. The city has a Federal building, built in 1889 at a cost of $120,000, a Carnegie Library and Mercy Hospital. There are paved streets, three parks, and splendid roads throughout the surrounding country. Near the town is a national cemetery.

Fort Scott is the trade center for a rich agricultural section, in which dairying is an important industry. There is much mineral wealth in the vicinity, including bituminous coal, in which there is a large trade, oil and gas, cement, rock, lead and zinc. Sulphur water is obtained from artesian wells. The principal industrial establishments are large railroad shops, a syrup factory, an overall factory and manufactories of cement, pottery, tile, leather goods and medicines.

Fort Scott was established by the Federal government in 1842 in what was then Indian Territory. The fort was abandoned in 1855. A settlement was organized in 1857, and it became a city in 1860. The commission form of government was adopted in 1914. H.A.B.

FORT SMITH, Ark., the county seat of Sebastian County, north of the center of the state, on the western state boundary line, 165 miles northwest of Little Rock, the state capital. It is in the Ozark Mountains, and on the Arkansas River, at the mouth of the Poteau River, and on the Saint Louis & San Francisco, the Arkansas Central, the Midland Valley, the Kansas City Southern, the Fort Smith & Western, and the Saint Louis, Iron Mountain & Southern railroads. Transfer and shipping are promoted by a belt line within the city. The street car service is extended by interurban electric line to Van Buren. The population in 1910 was 23,975; in 1916 it was 28,638, by Federal estimate. There are many Germans and Irish among the population.

The rivers are crossed at this point by four steel bridges. The city has a Federal building, erected in 1890 at a cost of $250,000; a Carnegie Library, a Union Station, Masonic Temple and several noteworthy bank buildings and churches. In addition to the public schools, which include a high school building costing $500,000, Fort Smith has a German Lutheran School and Saint Anne's Academy. Electric Park contains seventy-five acres; Cliff Drive is an oiled automobile road forty miles in length.

Fort Smith is in a rich agricultural section where two crops a year is the rule. Cotton, sorghum cane, sweet and Irish potatoes, grain, hay and fruits are raised. Near the city are forests of yellow pine, oak, hickory, etc. Manufactories are fostered by an abundant supply of natural gas and smokeless coal, both found in the vicinity. Industrial enterprises include cotton compresses, cottonseed-oil mills, smelters, a sorghum syrup mill, canning plant, oil refinery, coffee roasting and extensive manufactures of wagons, stoves, wheelbarrows, drays, chairs and every kind of furniture, saddles and harness, vitrified paving brick, crackers, peanut butter, etc. The shipping of cattle and hogs and agricultural and manufactured products constitutes an extensive commerce.

Fort Smith was built as a United States army post in 1817, and until the post was abandoned in 1871 it was the chief depot of the western forts. The town was organized in 1821, incorporated in 1842 and became a city in 1845. Near the old fort, which was the scene of several engagements in the War of Secession, is a National cemetery. The city adopted the commission form of government in 1913. G.S.

FORT SUM'TER, a fort in the harbor of Charleston, S. C., four miles southeast of the city, and distinguished as the scene of the first engagement in the War of Secession. At this period the national defenses in Charleston

FORT SUMTER
Before the bombardment in 1861.

harbor were in charge of Major Robert Anderson, whose headquarters were in Fort Moultrie. In 1860, South Carolina seceded and prepared to seize the United States forts in the harbor. Major Anderson, believing he was about to be attacked and realizing the weakness of Fort Moultrie, abandoned it and made Fort Sumter his headquarters. In April, 1861, he refused to surrender to General Beauregard, who vigorously bombarded and captured the fort on the thirteenth day of that month. Major Anderson and his command were permitted to leave the fort with honors of war. Sumter was held by the Confederates until the evacuation of Charleston in February, 1865, and in the following April the same flag that had been lowered in 1861 was raised over it with impressive ceremonies. See Fort Moultrie.

FORTUNA

FORTU'NA, in Roman mythology, was the goddess of chance, corresponding to the Greek *Tyche*. She differed from Destiny, or Fate, in that she dispensed joy or

sorrow at her own pleasure, and without regard to law. In Italy she was worshiped from a very early period, and had temples at Antium and Praeneste. In Greek art she is usually represented with a rudder, indicating her guiding power; with a cornucopia, as a symbol of prosperity, or with a ball, wheel or wings, typifying her fickle character. The English word *fortune* is therefore understood.

FORT WAYNE, IND., the county seat of Allen County, is a railroad center and manufacturing city in the northeastern part of the state, 102 miles northeast of Indianapolis and 150 miles nearly east of Chicago. It is on the Saint Joseph and Saint Mary's rivers, which continue from their junction within the city as the Maumee River, and on the Fort Wayne, Cincinnati & Louisville; Pennsylvania; Grand Rapids & Indiana; New York, Chicago & Saint Louis; Wabash and New York Central railroads. There is also interurban electric service. The area of the city is eleven square miles. In 1910 the population was 63,933; in 1916 it was 76,183, by Federal estimate.

Public Buildings and Institutions. Fort Wayne has a Federal building; a county courthouse, completed in 1902 at a cost of $1,000,000; a public library, costing $100,000, of which amount Mr. Carnegie donated $90,000; Saint Joseph's, Hope and Lutheran hospitals; a high school building, erected at a cost of $300,000, and several noteworthy churches. In Lawton Park (thirty-one acres) is a monument erected in honor of Major-General Henry Ware Lawton, who was killed while fighting in the Philippines. Other parks include Lakeside (twenty-two acres) and the smaller parks, Reservoir, Piqua and Old Fort, the last named being the site of Old Fort Wayne. The educational institutions include Concordia College (Lutheran), a college of medicine and surgery, a conservatory of music, a school of art and a school of oratory, expression and physical culture. Among the larger charitable institutions are the Indiana School for Feeble-minded Youth and several orphan asylums.

Industry. Fort Wayne is the distributing center of an extensive agricultural district. It has large shops of the Pennsylvania and the Wabash railroads, and among the important manufactures are Corliss and other steam engines, locomotives, freight and passenger cars, car wheels, boilers, electrical machinery, electrical fittings and fixtures, organs and pianos and many others of lesser importance. About 10,000 operatives are employed in the various industries, and the manufactured products have an annual value in excess of $15,000,000. Wholesale and jobbing houses distribute dry goods, groceries, hardware, drugs, millinery, paper and other commodities valued at $10,000,000 yearly.

History. Kekionaga, the principal village of the Miami Indians, was formerly within the present limits of Fort Wayne. A stockade fort, now the site of Old Fort Park, was built in 1794 by General Anthony Wayne. In 1813 it was besieged by Indians, who were routed after a hard fight. Six years later the fort was abandoned. A permanent settlement was made in 1815 and until 1830 it was an important fur-trading post. The town was incorporated and made the county seat in 1824, and in 1840 it became the city of Fort Wayne.

FORT WILLIAM, a city in the Thunder Bay district, Ontario, is a distributing point of importance. It is situated at the head of navigation on Lake Superior, at the point where it receives the waters of the Kaministiquia River, and three miles southwest of Port Arthur, with which it has steam and electric railway connection. Winnipeg is 419 miles northwest, and Montreal is 992 miles southeast, by rail; Duluth is 180 miles southwest, Sault Sainte Marie is 237 miles southeast, and Montreal is 1,056 miles also southeast, by water. Fort William is a meeting point for the Canadian Pacific, Canadian Northern and Transcontinental railways, and is a port of call for all passenger and freight steamer lines on the upper lakes. The Mount McKay and Kakabeka Falls Railway, built and operated by local capitalists, runs from Fort William to Kakabeka Falls, where water power for the city is developed.

Fort William was established as a Hudson Bay post in 1805, and was named in honor of William McGillivray, then chief factor of the Hudson's Bay Company, but it was not incorporated as a city until 1907. With the development of the Canadian Northwest, the city's growth has been rapid. The population increased from 3,633 in 1901 to 16,499 in 1911; in 1916 it was estimated at 20,000. Of this number about 10,000 are Canadians, the remainder being chiefly United States citizens, Finns, Swedes and Norwegians.

Fort William is located in a district rich in timber and agricultural products, especially grain; silver, copper and iron ores are also found here. Through excellent shipping facilities by water and by rail, the city and Port

Arthur, its neighbor, became the reshipping points for the great bulk of freight passing into and out of Western Canada. In Fort William alone there are eighteen grain elevators, with a total capacity of 30,000,000 bushels. The leading industrial establishments are large flour mills, having a daily output of about 15,000 barrels, stove and car-wheel foundries, breweries, shipbuilding yards, factories for making various kinds of building supplies, and plants for making heavy iron and steel implements.

Noteworthy buildings are the post office and custom house, the $85,000 city hall, erected in 1905, and the public library. The park reservations cover 125 acres. Points of interest in the vicinity are Mount McKay, Kakabeka Falls, 120 feet high, and Sleeping Giant, or Thunder Cape, eighteen miles across Thunder Bay. A.MC N.

FORT WORTH, TEXAS, the county seat of Tarrant County, is a rapidly growing shipping and manufacturing center, in the northeastern part of the state. In 1876 there were fewer than 1,000 inhabitants. By 1910 this number had increased to 73,312 and in 1916 to 104,562, by Federal estimate. The city has an area of more than sixteen square miles.

It is attractively situated on an elevated plain at the junction of forks of the Trinity River. Dallas is thirty miles east, Austin 175 miles south, and El Paso 615 miles west and south. It is on the Texas & Pacific; the International & Great Northern; the Chicago, Rock Island & Gulf; the Gulf, Colorado & Santa Fe; the Fort Worth & Denver City; the Saint Louis Southwestern (Cotton Belt); the Saint Louis & San Francisco; Missouri, Kansas & Texas and the Sunset-Central Lines. In addition to these there are two electric interurban lines.

Buildings and Parks. The Federal building, Tarrant County courthouse, built of granite and marble from Texas quarries, the city hall, Central High School, union railway station, Coliseum and the Chamber of Commerce Auditorium are the noteworthy structures. There are twenty-one parks, varying from one-half acre to 113 acres in area. About the city are unexcelled hard-surfaced country roads.

Educational Institutions. Fort Worth is the seat of the Texas Christian University, with which in 1913 was united the Fort Worth Medical College; Texas Woman's College, the successor of the Polytechnic College (Methodist Episcopal); Baptist Theological Seminary; Southland University (state school of the Disciples of Christ); Saint Andrew's School (Protestant Episcopal); Saint Ignatius Academy (Roman Catholic); Masonic Orphans' Home and School for Texas, and a number of smaller denominational and technical schools. The city has a Carnegie Library, a law library and the medical college library.

Industries. Most of the trunk lines of Texas converge at Fort Worth, making the city one of the most important shipping centers of the southwest and a reshipping point for almost the entire state. Agriculture and stock raising are the supporting industries of the vast surrounding country. The grain handled annually by elevators and mills in Fort Worth is valued at over $35,000,000, and the cotton business exceeds $50,000,000 annually. The wholesale fruit and produce business amounts to $60,000,000.

Meat packing houses in 1914 slaughtered 1,985,426 animals; Fort Worth ranks well with the leading cities in this industry. Among the other important industries are included cornmeal and stock-feed mills, cotton and oil mills, railroad repair shops, foundries and machine shops, silo plants and many lesser manufactories. The city is an important horse and mule market.

In view of the possible failure of the water supply from a number of artesian wells, the city has constructed a large storage dam on the west fork of the Trinity River, seven miles distant. This work cost $1,500,000, and it has a storage capacity of thirty billion gallons.

History. In 1849 a military camp called Fort Worth was established on the present site of the city. The camp was abandoned, and a later settlement, which became the county seat in 1860, was incorporated in 1873. The fort and settlement were named in honor of General William Jenkins Worth. The commission form of government was adopted in 1907; the departments consist of five commissioners, mayor and tax collectors.

FO'RUM. When used without modification this word usually refers to the great Forum, the center of the life of ancient Rome. It lay in the hollow between the Palatine, the Quirinal and the Capitoline hills, and to it flocked the dwellers on those heights. Here, in the early centuries of the city's life, were the markets, where the farmers displayed their fruits and vegetables and the fish dealer his wares; here the political meetings were held,

and here the devout gathered to worship the gods. At first everything connected with the Forum was largely informal—it was merely an open gathering-place, often unpleasantly marshy. But as the city grew the Forum was leveled and drained by the great sewer known as *Cloaca Maxima;* shops were built about the edges, and temples began to spring up. Later the shops were banished to new market-places, and the Forum assumed an added dignity. The emperors delighted to ornament it

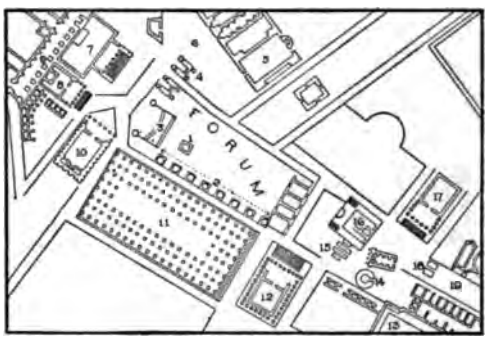


DIAGRAM OF THE FORUM

(1) Column of Phocas
(2) Bases of Honorary Statues
(3) Rostrum
(4) Arch of Septimius Severus
(5) Curia, or Senate House
(6) Comitium
(7) Temple of Concord
(8) Temple of Vespasian
(9) Tabularium, or Office of Records
(10) Temple of Saturn
(11) Basilica Julia
(12) Temple of Castor
(13) Atrium Vestae (House of the Vestals)
(14) Temple of Vesta
(15) Arch of Augustus
(16) Temple of Julius
(17) Temple of Antoninus and Faustina
(18) Arch of Favius
(19) Via Sacra

with buildings, arches and statuary, and in the days of the empire it was an imposing sight, with its pillared temples, its gleaming columns and its shaded walks. The illustration shows the location of the most prominent buildings.

It was not the architecture, however, which made the Forum the wonder of the ancient world, but the teeming life which flowed through it. Stately Romans in their flowing togas walked beneath its arches; dignified Senators hastened to it, intent on measures which might save or disrupt the empire; there was the echo of clashing arms from its walls, as soldiers returning victorious from some far province marched through it; and many a conquered enemy of royal rank was led captive under its arches. Here, in the Senate House, Cicero delivered those renowned speeches which overthrew Catiline; here Brutus made his defense after the death of Caesar, and here Mark Antony swayed the passions of the mob to vengeance and violence. The history of the world of that day was largely made here, for Rome was the all-important part of the world in those days of splendor.

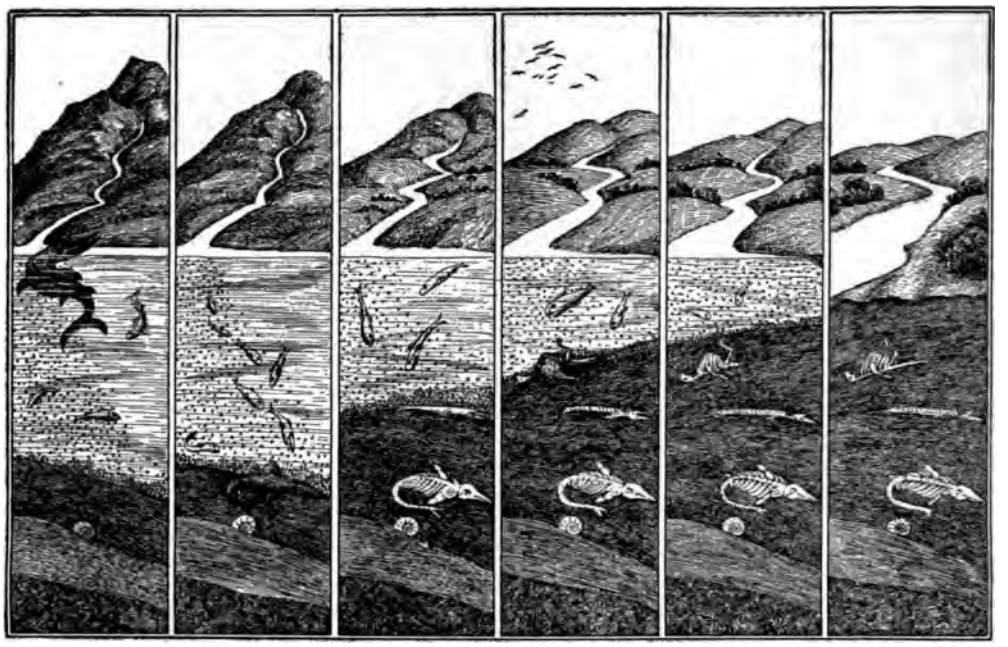
When the barbarians poured into Rome in the fifth century they spared the Forum, but later centuries were not so kind, and all during the Middle Ages the Forum was little more than a desolate waste, its buildings tumbled in ruins or buried under rubbish. Its condition is plainly shown by the fact that it was called Cow Plain. In recent years clearances and excavations have been undertaken, and some valuable relics have been unearthed.

Other Forums. The word *forum* means simply *out-of-doors,* or *market-place,* and was by no means restricted to the one open-air place described above. Rome itself had many more, several of the emperors setting aside and beautifying forums in their own honor. Julius Caesar began the custom, and Augustus, Vespasian, Domitian, Nerva and Trajan followed his example. Some of these had architectural beauties as great as those of the old Forum, but they never took the same part in the city's life, and it alone bore the title of *Forum Romanum.* Practically every Roman city, whether in Italy or in the colonies, had at least one forum, and no study of the life of ancient times is complete which does not give much attention to these great unifying, civilizing agencies. See ROME. A.MC C.

Consult Hülsen-Carter's *The Roman Forum;* Platner's *The Topography and Monuments of Ancient Rome.*

FOSSIL, *fos'il.* We sometimes find pieces of shell in a rock and look upon them as great curiosities. If we examine the rock more closely by using a magnifying glass, we may discover that it contains the remains of tiny animals that have turned to stone, that is, have *petrified.* These remains of plants and animals that have turned to stone are *fossils.* We may well look upon them as curiosities, for they tell us of the animals and plants that lived in the past geologic ages, long before man came upon the earth.

Fossils are of the greatest importance to the geologist, for it is by studying them that he is able to tell the order in which the different rock systems were formed. For instance, the rocks that contain no fossils must have been formed before either plants or animals could live on the earth. Again, it is reasonable to suppose that the simplest forms of life appeared first, hence the rocks in which fossils



WHY FOSSILS ARE FOUND IN THE EARTH

In the course of ages the hills wear away by erosion (which see) and their deposits fall to the bottoms of streams and lakes, gradually filling them up, or lessening their depths. Animals and plants die and are covered, and possibly in hundreds of thousands or millions of years evidences of them are discovered by excavation. The above illustration suggests but one of the means by which fossils are formed.

of these forms are found are believed to be older than those in which fossils of more complex forms occur. These studies lead us to believe that plants came into existence before animals, and that animals with a simple structure, like the shellfish and starfish, came before those of a more complex structure. The study of fossils tells us that there were no animals with backbones (vertebrates) before the Silurian Period, and that during the Devonian Period fishes reached their highest development. These were followed by reptiles, which in turn were followed by birds, and these by mammals, which were the forerunners of the animals of the present time. The fossils of animals are much easier to study than those of plants, because they are better preserved. The study of fossils forms the study of paleontology.

Related Subjects. The reader is referred to the following articles in these volumes:

Devonian Period	Paleontology
Geology	Silurian Period

FOSTER, JOHN WATSON (1836-), American diplomat of high rank, and a statesman and author, was born in Indiana. He was graduated at Indiana State University in 1855, admitted to the bar in 1857, and served in the Union army during the War of Secession. From 1873 to 1880 he was minister to Mexico, then for two years minister to Russia, and in 1883 minister to Spain. In 1892 he succeeded James G. Blaine as Secretary of State in the Cabinet of President Benjamin Harrison. In 1893 he was agent in the Bering Sea arbitration at Paris; in 1898 member of the Anglo-Canadian commission; in 1903 agent in the Alaskan Boundary Tribunal at London; and in 1907 was appointed delegate from China to the Second Hague Conference. Probably no other man in America has had a longer or more honorable public career in diplomacy. His son-in-law, Robert Lansing, became Secretary of State under President Wilson. His writings include *A Century of American Diplomacy, Diplomatic Memoirs* and *The Practice of Diplomacy.*

FOSTER, SIR GEORGE EULAS (1847-), a Canadian statesman, Dominion Minister of Trade and Commerce since 1911, the only member of the Borden Ministry who had previously held a Cabinet office, and the only man who has served under all the Conservative Premiers from Macdonald to Borden. His early years gave little indication of his later career. Born in New Brunswick, he attended

the University of New Brunswick, from which he was graduated in 1868. After pursuing his studies further at the universities of Edinburgh and Heidelberg, he returned to New Brunswick and for several years was a teacher, finally becoming professor of the classics at his *alma mater*. He resigned his professorship in 1879 and in 1882 entered political life as a Conservative member of the House of Commons.

In Parliament his scholarship and ready wit in debate won immediate recognition. In 1885 Sir John A. Macdonald appointed him Minister of Marine and Fisheries, a position which he exchanged in 1888 for that of Minister of Finance. He remained as Minister of Finance in the ministries of Macdonald's four Conservative successors, and after the defeat of his party in 1896 remained in the House of Commons as a member until 1900. In 1904 he was again elected to the House, and in 1911 was appointed Minister of Trade and Commerce by Premier Borden. King George in 1914 created him a Knight Commander of the Order of Saint Michael and Saint George. Sir George is known as an advocate of temperance, and as early as 1895 supported a resolution in Parliament for the extension of suffrage to women. He is also a strong Imperialist, and favors preferential tariffs within the empire. G.H.L.

FOSTER, STEPHEN COLLINS (1826-1864), composer of *My Old Kentucky Home,* prob-

FOSTER'S HOME
House in Bardstown, Kentucky, where *Old Kentucky Home* was written.

ably with the exception of *Home, Sweet Home* the most extensively-translated song in the world. Every part of Europe has a version of it, and even in Asia and Africa the natives have sung it in their own tongues. Over 400,000 copies of this song were sold five years after its publication; at the time it was a record never before equaled.

Without any formal training in music, he composed about 125 songs, more than any other man ever produced. Nearly a fourth of these are negro melodies and the remainder are sentimental ballads; both the music and words of all of them were of his own composition. It was generally supposed that no one not born in the South could produce negro melodies such as were composed by Foster, who was a native of Pittsburgh, Pa.

Foster was of a retiring nature and cared little for fame and money, but he could not escape popularity. It is said that for *The Old Folks at Home (The Suwanee River)* he received only $500; his publisher netted over $10,000 for his *The Louisiana Belle* and *Old Uncle Ned.* Other songs which brought him great fame are *Nelly Bly, Old Dog Tray, Way Down South Where de Cotton Grows, Gentle Annie, Willie We Have Missed You* and *Come Where My Love Lies Dreaming.* He preferred his sentimental songs to his plantation ditties, but it is for the latter that he will be most gratefully remembered.

FOSTO'RIA, OHIO, a city in Seneca and Hancock counties, near the boundary of Wood County, in the northwestern part of the state, thirty-five miles south of Toledo. It is on the Baltimore & Ohio, the Hocking Valley, the Lake Erie & Western and the New York, Chicago & Saint Louis railroads. The city has electric interurban service. In 1910 the population was 9,597; in 1916 it was 10,770, by Federal estimate. The area of the city exceeds two and one-half square miles.

Fostoria is in an agricultural country and near large oil fields. It has glass factories and lime kilns, and manufactures glass novelties, automobile and incandescent lamps, barrels, safes and machinery. The city has a Carnegie Library and a Y. M. C. A. building. It was founded in 1832 and became a city in 1854. Its growth and development were promoted by Charles Foster, later governor of Ohio and Secretary of the United States Treasury, and it was named in honor of his father, the first settler.

FOUCAULT, *foo ko',* JEAN BERNARD LÉON (1819-1868), a French physicist, born in Paris, whose name is associated with a pendulum experiment employed as a method of showing the rotation of the earth on its axis.

Two years after his appointment (1855) as physical assistant in the Paris observatory, he invented the polarizing prism which bears his name, and later he completed a reflector for the great telescope at Paris. He also is credited with the invention of the gyroscope and an apparatus for the better application of electric light, and he made many important discoveries in optics and photography. He was the first to discover that the sun may be viewed without injury to the eyesight if the object glass of a large telescope be covered with a thin film of silver. See GYROSCOPE.

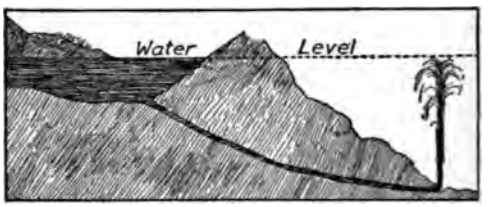
FOUNDLING HOS'PITALS, institutions for children who are abandoned by their parents because of poverty, or because they do not wish to keep them. They are also homes for orphan children. In America, foundling hospitals are found in most of the larger cities, although in Massachusetts they have been abolished by law. Such institutions have to be protected by strict laws in regard to the admission of children, or they would be imposed upon by people guilty of illegal practices. In the main, the law is concerned with the abuse which may attend such hospitals, in connection with illegitimacy, and with the care given to helpless infants confided to them.

The death rate among the children at these places is seventy-five per cent, so the better institutions try to have the mother stay and nurse her child, unless they can persuade her not to abandon it. The New York Foundling Asylum has adopted the plan of placing as many children as possible in private homes for board. Those receiving such children must care for them according to the rules of the institution.

FOUND'RY, a place where metal castings are made. The Latin word *fondere* means *to pour*, and *founding* is literally a process of pouring molten steel, iron, brass or bronze into molds. The latter are usually of sand, and their design requires great skill. In hand molding a box called a *flask* is filled with sand, into which is then pressed a pattern of wood or metal the exact shape of the article to be manufactured, but slightly larger because the metal will contract in cooling. The sand is then packed tightly, and the pattern must taper toward the bottom or it will be impossible to withdraw it without spoiling the mold which has been formed. For patterns of irregular form molds are made in two or more parts. For a hollow casting a *core* of hardened sand is suspended within the mold. If any of the sand falls into the casting a *sand-hole* may result, perhaps rendering it useless.

The principles of machine molding are essentially the same as of hand molding, but the sand is packed and the patterns applied by machinery, with resulting increase in accuracy and speed for some varieties of work. For further information relating to cast iron and cast steel, see IRON.

FOUNTAIN, *foun'tin*. According to mythology, in the ages long ago the beautiful woodnymph, Arethusa, who loved to go hunting, returned one day heated from the chase and went to bathe in the river. A voice from the



A NATURAL FOUNTAIN

Except for the opposing forces of atmospheric pressure and the attraction of gravitation, a fountain will rise as high as its source.

depths of the stream startled her, and she fled, but the voice followed, saying, "Why flyest thou, Arethusa? Alpheus am I, the god of this stream." Faster and faster she ran, but the god pursued her, so Diana changed her into a lovely fountain to save her. This ancient myth shows how the Greeks and Romans associated the gods with any unusual thing in nature, such as the natural fountain which shoots a stream of water from the ground and drops it into a basin formed around it. Just such a fountain is that of Vaucluse, in Southern France, where from 117,000 to 350,000 gallons of water shoot every minute into a circular pool surrounded by lofty cliffs. From there the water flows off through a ravine to form twenty brooks.

The operation of a fountain is based on the following principles: The flow of the fountain is caused by the pressure of the water in the pipe or crevice connecting the opening, through which the jet flows, with the reservoir. The higher the reservoir is above this opening, the higher will be the flow of the jet, on the principle that a jet of water will extend upward to the level of its source. This, however, will not hold true in practice because of friction, which keeps the jet a little lower than the source.

Many beautiful artificial fountains have been

made by forcing water up through pipes. The Tyler-Davidson fountain, which is considered one of the finest in the world as well as a masterpiece of art, is located in Fountain Square, Cincinnati, and was presented to the city by Henry Probasco, after being cast at the royal foundry, Munich, at a cost of $200,000. Another beautiful fountain is the *Spirit of the Great Lakes* by Lorado Taft (see illustration in article on CHICAGO), which is located at the south end of the Art Institute in Chicago. The five female figures represent the five Great Lakes of North America, and as each pours the water from her shell it falls into the basin below. Some of the famous fountains of recent date have been constructed for great expositions, such as the *Fountain of the Republic,* by Macmonnies, at the World's Columbian Exposition in Chicago in 1893; the fountain of *Man, Nature* and *Progress* at the Pan-American Exposition in Buffalo in 1901; the *Cascades* at the Louisiana Purchase Exposition at Saint Louis in 1904; and the *Fountain of the Earth* by Robert Aitken and the *Fountain of Energy* at the Panama-Pacific Exposition in 1915.

The fountains of the Greeks and Romans combined ornament and utility, for they supplied water for the poor who could not afford to have it brought to their homes. Many beautiful ones were constructed in Italy, France and Spain. The most famous in Europe are the Schöne Brunnen at Nuremberg, Germany; the Fontana Maggiore at Perugia, Italy; the Fontaine des Innocents at Paris, and the Alameda Fountain at Malaga, Spain.

FOUNTAIN OF YOUTH, a mythical spring supposed by certain old tribes of Indians in Central America and the West Indies to exist in a northern region called Bimini. Its waters were believed to restore youth and heal sickness. This legend was common to the peoples of many lands. The Indians made expeditions to Florida and the Bahamas in search of this spring; and early in the sixteenth century Ponce de Leon, Narvaez, De Soto and others led bands of explorers into the interior to seek it. A spring in Saint Augustine, Florida, which now has a paved courtyard and canopy, is said to be one of the many discovered by Ponce de Leon in his search for the elusive youth-restoring fountain.

FOUR-O'CLOCK, or MARVEL OF PERU, an old-fashioned South American plant, so called because its blossoms open late in the afternoon. Four-o'clocks send forth their fragrance to the night moths and insects, but close in the morning, never to open again, for each flower blooms but once. This plant thrives almost anywhere and is cultivated in gardens throughout America, especially as a bushy border plant or hedge, growing about two feet high. If the large dahlialike roots are saved and planted in the spring, stronger plants will grow than if seed is sown.

FOUR-O'CLOCK

Throughout the summer, until frosts appear, these plants send forth a succession of flowers, red, pink, yellow or white; sometimes there are several colors on one branch. The leaves are attached in pairs, are heart-shaped at the base, sharply-pointed at the tip, and the edges are smooth. The flowers are funnel-shaped, spreading into five-notched lobes whose edges overlap. Above the flower opening appear five slender stamens, and above these stretches a slender thread ending in a white knob. When the flower has withered it will be seen that at the end of this thread a seed-pod has grown, in which rests one large seed.

The bare-headed, dull-plumaged *friar bird* of Australia is called four-o'clock, in imitation of its cry.

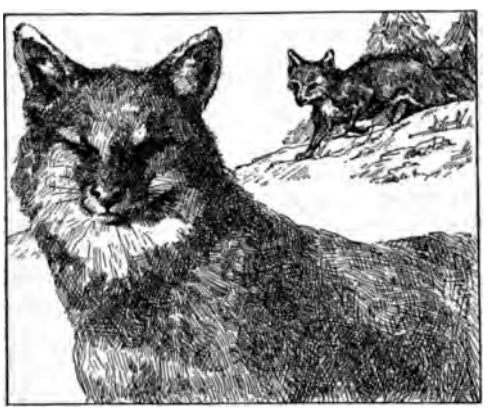
FOURTH OF JULY. See INDEPENDENCE DAY.

FOWL, *foul,* a word derived from the Anglo-Saxon *fugol,* and the German *vogel,* meaning a *bird.* It is now applied generally to certain land and water birds known respectively as wild-fowl and waterfowl, but more particularly to the common domestic chicken. There are many varieties of domestic fowls, but all are more or less directly descended from the wild pheasant (which see). Careful breeding and selection have modified the form and coloring, but many of the original characteristics remain. The feet and beak of the fowl are similar to those of the pheasant, but it grows a naked fleshy substance called a *comb* instead of the feathers ornamenting the top of the pheasant's head.

The fowl has been domesticated for over 2,000 years, and has gradually spread from the East Indies, China and the Malay Archipelago, of which countries it is a native, to every part of the world. Most common of the varieties is poultry, closely followed in economic value by ducks and geese (see POULTRY;

DUCK; also the leading wild game birds, all described under their titles). The male chicken, except in cases of pure white or pure black varieties, is always more brightly-colored than the female. In addition to this, the male is further ornamented by two long feathers in the tail, which fall in a graceful arch and greatly improve his appearance. The cock is a vainglorious boaster; tradition hands down the story that he is filled with pride because he believes his crow causes the sun to rise. The hen is more modest and retiring, only showing pride when she has laid an egg or hatched a brood of chickens.

FOX, one of the most cunning of the beasts of prey, an animal related to dogs, wolves and jackals. Species of fox are found wild in all countries of the northern hemisphere, and breeding of foxes in captivity, for future use



Treason is but trusted like the fox
Who, ne'er so tame, so cherished or locked up,
Will have a wild trick of his ancestors.
—SHAKESPEARE: *Henry IV.*

of their fur, is a rapidly growing, paying industry. Silver-black fox fur, with its rich brilliance and sheen, has been considered the choicest and most valuable since the use of furs began. Realizing the gradual decrease in numbers of the silver-black fox and the constant demand for its fur, a man in Prince Edward Island began breeding them about the year 1890. The industry quickly developed, and it has been growing and spreading to all parts of the world. As yet the animals are not freely killed for their furs, for the live animals, sold in pairs for breeding purposes, are so much in demand that some are worth as much as $35,000, the prices per pair ranging from $4,000 upward. One pelt, however, easily brings $1,000 while the supply is yet limited. Pelts of the *blue* or *Arctic fox* are also very valuable, and fur-farming is an important industry on the Aleutian Islands. Ordinary pelts of the plentiful *red fox* bring from $5 to $8 each. Beautiful silver-gray pelts of the *gray fox* sell for as much as $50 each.

Foxes differ in size from their relatives, the wolves and jackals, being generally smaller and having larger, more furry and triangular ears, more pointed muzzles and straighter jaws, longer and more bushy tails and longer hair. All foxes live in holes in the earth, or in holes in rocks or trees; but unlike most burrowing animals, they do not sleep throughout the winter. They prowl about at night, stealthily approaching their prey of woodchucks, rabbits, ground birds, poultry, etc., or sometimes lambs, which they capture with a quick rush. When other food is scarce, however, they will consume rats, mice, frogs, worms, beetles or even fruits. Foxes breed in early spring from the first year and sometimes for ten years thereafter, producing annually from three to seven young. The life of the fox is from fourteen to sixteen years. The eyes of the young do not open until from nineteen days to a month after birth, and after that time, for about two months, both parents watch them and protect them carefully, and the mother fox nurses them for six months. A yelping bark is the call and cry of the fox. The scent which hounds of the huntsmen follow is secreted by a gland beneath the tail. When a fox is captured it will sometimes pretend it is dead, and will endure the roughest treatment without a sign of life.

In addition to the species already mentioned, all of which are natives of America, there are the yellowish-gray *kit, swift,* or *burrowing fox* of the dry plains of Western America; the small, pretty *India fox;* the pale *desert fox* of Arabia and Afghanistan; and the *red fox* or *Reynard,* of Europe, immortalized in numerous tales and fables, and through England's greatest of sports, the interesting and exciting fox

FOX, a tribe of Indians of Algonquian stock,

Consult Seton's *Biography of a Silver Fox;* Tregarthen's *The Life Story of a Fox.*

FOX, a tribe of Indians of Algonquian stock, called in their own language *Meshkwakihug,* or *Red-Earth People.* Their familiar name, Fox, was given them by the French. When first known to the white man they were living in Central Wisconsin, having been driven there from the Lake Superior region by the attacks of the Ojibwa. In order to protect themselves from this tribe and from the French, they

united with the Sac Indians about 1760, and the two tribes have since then been practically one. They are scattered over Oklahoma, Iowa, Kansas and Nebraska, and number about 700. The Fox were a woodland people, living in bark houses and raising corn and vegetables. See SAC.

FOX, CHARLES JAMES (1749-1806), a brilliant English statesman and orator, a friend of the American colonies in their fight for freedom. He was born at Westminster, educated at Eton and Oxford, and in 1768 entered Parliament as a Tory. He was junior lord of the admiralty and treasury, 1770-1774, during Lord North's ministry. Later he joined the Whig party, and in 1762 was foreign secretary under Lord Rockwell. He supported the cause of the American colonies in Parliament during the American Revolution, and because of this his political career was disturbed by the enmity of King George III and by the bitter opposition of Pitt. *The History of the Reign of James II,* although incomplete, is the most important of his writings, but is considered of little historic or literary value.

FOX, GEORGE (1624-1691), born at Fenny-Drayton, Leicestershire, England, was the founder of the Society of Friends, or Quakers, the organization of which was completed about 1669. At the age of twenty-one he believed himself to be the subject of divine call, and wandered from place to place spreading his views respecting religious reforms. He made missionary journeys through Ireland, Scotland, the West Indies, North America and Holland, and had many followers. He was frequently imprisoned for his public denial of the Scriptures as the source of divine truth, and in 1655 was examined on such charges and acquitted by Cromwell. His followers were first called *Quakers* because he had exhorted the magistrates "to tremble at the word of the Lord." See QUAKERS.

FOX, JOHN [WILLIAM] Jr. (1863-), author of a large number of novels dealing with the mountaineers of the Southern United States, was born in Kentucky and was graduated from Harvard University in 1883. Principal among his works is *The Trail of the Lonesome Pine,* which was dramatized and successfully produced for a number of years. Other romances include *The Little Shepherd of Kingdom Come, The Heart of the Hills, A Mountain Europa* and *Following the Sun Flag,* the latter being an account of his experiences in the Russo-Japanese War. In 1908 Mr. Fox married Fritzi Scheff, an actress, who divorced him several years later.

FOXGLOVE, a flowering plant, beautiful along walks and in shrubberies. It is a native of Europe, but is now common in America, thriving in light, rich soil, which must be partially shaded. The leaves are long, oval, rough and downy. The flowers are drooping tubes of lilac, rose, yellow or white, closely clustered on a spike, and all turning to one side. *Digitalis* is its Latin name, meaning *finger;* the thimble shape of the flowers no doubt suggested the name.

From the leaves and stems of the stately foxglove is prepared the drug *digitalis,* a bitter substance which is used to stimulate heart action; in large doses, however, it may prove fatal. See MEDICINE AND DRUGS.

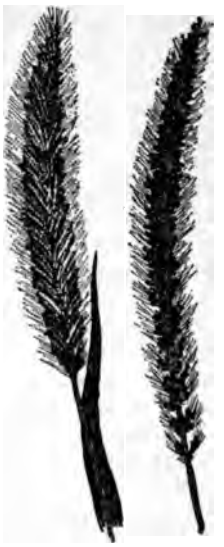
FOXHOUND, a strong, speedy hound, remarkable for its keen scent and endurance. It is descended from the bloodhound, the principal characteristics of that animal being considerably changed by careful selection and

FOXHOUND

breeding. To the strength of the bloodhound has been added some of the fleetness of the staghound. The foxhound is largely white, with patches of black or tan; it has short coarse hair, large ears and straight, sturdy legs. The usual height is from twenty to twenty-two inches. This dog is very intelligent and is easily trained, and is reliable in following the scent of foxes. The well-bred, highly trained foxhounds in English hunting packs are the result of generations of attention and care.

FOXTAIL GRASS, a valuable fodder grass found in all temperate countries, which bears flower clusters in shape remotely like a fox's tail. The *meadow* foxtail grass, with its silvery hairs, is very hardy and one of the best pasture

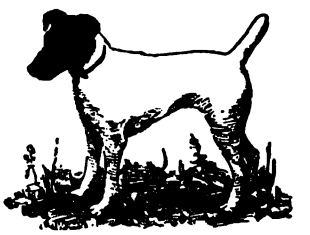
grasses introduced into America from Europe. The *mountain* species, found in the rich soil along streams in the Rocky Mountains, yields a large amount of excellent hay and is proving valuable for cultivation in the New England and north Middle States. A few other species are dry and harsh and sometimes troublesome as weeds.



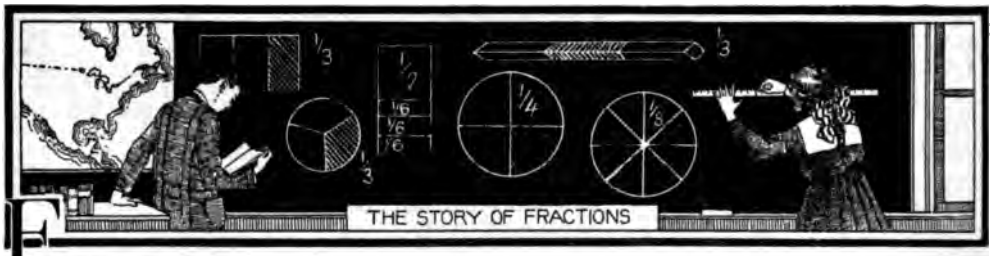
FOXTAIL GRASS

Foxtail millets, which are closely related to the grasses, found in all the warmer and temperate regions, are very valuable for forage, and some species as food for man. See MILLET.

FOX TER'RIER, a small, lively, short-haired dog, probably the most popular of all terriers. It is a very quick, intelligent and tireless animal, and is of the species most frequently seen in dog performances. It was formerly employed to drive foxes from their holes for hunters, and this accounts for its name; but it is now chiefly kept as a pet. In color it is usually white, with black and tan markings on the head. In a thoroughbred the head should be flat and rather narrow, with strong jaws, small eyes, small V-shaped ears carried close to the head, and nose black and tapering. The legs should be straight and strong. Carried gaily is a high-set tail, which is usually docked. Some fox terriers have smooth coats, but others have hair hard and wiry. The average weight of one of these animals is twenty pounds, and its length of life is about fifteen years. It is a very affectionate animal.



SMOOTH FOX TERRIER



FRACTIONS, COMMON. A fraction is one or more of the equal parts into which a unit is divided. There are two general classes of fractions, *common* and *decimal* fractions. The former are written with one number above a dividing line and one number below. (For the discussion of decimal fractions see the article DECIMAL FRACTIONS.) Let Fig. 1 (below) represent a piece of cardboard 16 inches long and 5 inches wide. Each of the divisions marked ¼ represents one of the four equal parts of the entire piece. The portions designated as ½ are each equal to two of these parts; that is, each is one-half of the entire piece.

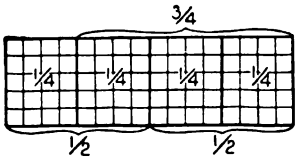


FIG. 1

Five boys in a manual training shop have a rectangular piece of leather which is to be divided equally among them for their work (see Fig. 2). Each boy takes one-fifth of the piece. He knows that this portion is his share because he sees that each boy can take a piece the same size as his. The boys must have some measure by which they can divide the piece into five equal parts. They probably use a measure which they all recognize as a standard, such as the inch. Having decided on this standard, they may measure the length of the piece and find it 20 inches, while the width is the same throughout. In the drawing are shown the divisions.

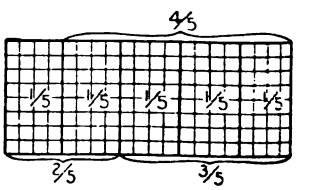


FIG. 2

FIG. 3

Two boys use two-fifths; three boys use three-fifths; four boys use four-fifths of the piece. All the boys use five-fifths of the piece, or all of it. If only three boys take their parts there will be left two-fifths of the piece. If four boys take their parts only one-fifth of the piece is left.

John and Eric have a dollar which they are to divide equally between them. They may use as their measure one dime, one quarter, one penny or one-half dollar.

(1) If they change the dollar for dimes, they have 10 dimes, and each one takes 5 dimes, or five-tenths of the dollar (see Fig. 3).

(2) If they change the dollar for quarters, each one takes two quarters and has two-fourths of the dollar (see Fig. 4).

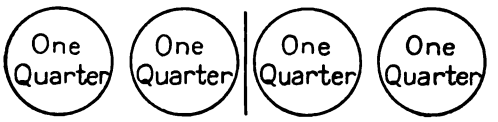


FIG. 4

(3) If they change their dollar for pennies, each one takes 50 pennies, and has fifty-hundredths of the dollar. But in each case, each boy has one-half of the dollar because there are two boys who receive equal parts of the dollar.

So we see here that five-tenths, two-fourths, fifty-hundredths and one-half of a dollar are all of the same value.

The fractions named above are written thus: $\frac{5}{10}$, $\frac{2}{4}$, $\frac{50}{100}$, $\frac{1}{2}$. We see that $\$\frac{5}{10}=\$\frac{1}{2}$; that $\$\frac{2}{4}=\$\frac{1}{2}$; that $\$\frac{50}{100}=\$\frac{1}{2}$; that $\$\frac{50}{100}=\$\frac{5}{10}$; that $\$\frac{50}{100}=\$\frac{2}{4}$.

Common fractions are written as above; the number below the line tells the number of parts into which the whole is divided, and the number above the line tells how many of these parts we are considering, or are working with. The number below, which is called the *denominator*, shows the unit of measure, while the number above the line, called the *numerator*, shows how many such units of measure we are considering. For example, $\frac{3}{4}$ foot means that $\frac{1}{4}$ foot is used as a unit of measure, and the whole length measured contains *three* of the measuring units. Fig. 5 shows the measuring unit, the whole length undivided, and the whole length measured.

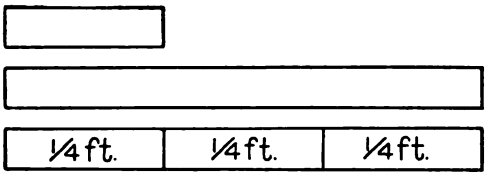


FIG. 5

The denominator and numerator together are called the *terms* of a fraction.

Reduction of Fractions to Higher and Lower Terms. The process of reducing fractions to higher or lower terms, without changing the value, enters into numerous practical problems.

(1) From Fig. 6 (upper diagram) we see that $\frac{1}{8}=\frac{1}{2}$; $\frac{2}{8}=\frac{1}{4}$; $\frac{6}{8}=\frac{3}{4}$.

(2) From Fig. 6 (middle diagram) we see that $\frac{2}{6}=\frac{1}{3}$; $\frac{3}{6}=\frac{1}{2}$; $\frac{4}{6}=\frac{2}{3}$.

(3) From Fig. 6 (lower diagram) we see that $\frac{1}{8}=\frac{3}{24}$; $\frac{2}{8}=\frac{6}{24}$; $\frac{1}{4}=\frac{6}{24}$; $\frac{1}{2}=\frac{12}{24}$; $\frac{15}{24}=\frac{5}{8}$; $\frac{16}{24}=\frac{2}{3}$; $\frac{9}{24}=\frac{3}{8}$; $\frac{21}{24}=\frac{7}{8}$.

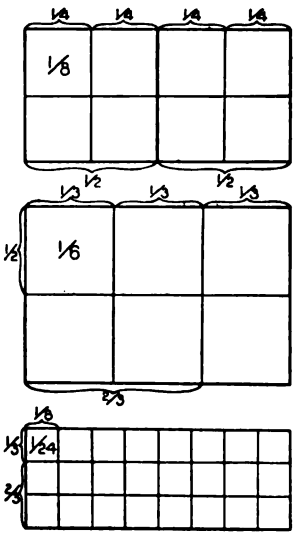


FIG. 6

(4) In general, we see that two fractions of different form may have the same value.

(a) Divide a yard into three equal parts; one part is $\frac{1}{3}$ of a yard, or 12 inches.

(b) Divide a yard into six equal parts; one part is $\frac{1}{6}$ of a yard.

$\frac{1}{6}$ yard is only $\frac{1}{2}$ as long as the $\frac{1}{3}$ yard obtained (a) by dividing the yard into three equal parts; to obtain a part 12 inches in length, we must use as a measure two $\frac{1}{6}$ yard, or $\frac{2}{6}$ yard. It follows then that $\frac{2}{6}$ yard equals $\frac{1}{3}$ yard.

As the denominator grows larger, the unit

part grows smaller, and the number of parts considered or used (shown by the numerator) must grow greater when we desire to keep the value of the fraction fixed. Thus $\frac{2}{3}$ yard shows that $\frac{1}{3}$ yard is the unit of measure in use, and that two such units are under consideration in the form $\frac{2}{3}$ yard. Let the unit of measure be changed to $\frac{1}{6}$ yard, and four such units must be used to keep the value $\frac{2}{3}$ yard. Let the unit of measure be changed again to $\frac{1}{12}$ yard, and eight such units must be used to keep the value $\frac{2}{3}$ yard. $\frac{2}{3}$ yd.$=\frac{4}{6}$ yd.$=\frac{8}{12}$ yd.

These facts may be summarized thus: ***Multiply both terms of a fraction by the same number and the value of the fraction remains the same,*** as, $\frac{2\times 2}{3\times 2}=\frac{4}{6}$.

Divide both terms of a fraction by the same number and the value of the fraction remains the same, as, $\frac{8\div 4}{12\div 4}=\frac{2}{3}$.

Divide both terms of a fraction by the same number; repeat this with the resulting fraction until the terms have no common factor; then the fraction is in its lowest terms; or, ***divide both terms of the fraction by their greatest common factor; then the fraction is in its lowest terms;*** for example,

$\frac{24\div 4}{96\div 4}=\frac{6}{24}$; $\frac{6\div 6}{24\div 6}=\frac{1}{4}$; or $\frac{24\div 24}{96\div 24}=\frac{1}{4}$.

(See Fig. 7.)

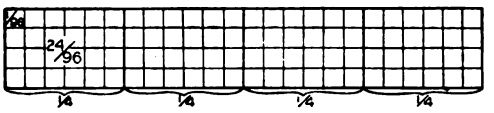


FIG. 7

Problems. Reduce the following fractions to lowest terms: $\frac{12}{15}$, $\frac{16}{20}$, $\frac{36}{48}$, $\frac{7}{21}$, $\frac{18}{27}$, $\frac{16}{24}$, $\frac{45}{60}$, $\frac{8}{36}$, $\frac{22}{99}$, $\frac{14}{35}$, $\frac{42}{105}$, $\frac{100}{150}$, $\frac{150}{300}$, $\frac{756}{1890}$, $\frac{261}{657}$, $\frac{378}{3181}$, $\frac{3111}{4554}$. To find the common divisors of numerator and denominator, in difficult cases, refer to DIVISIBILITY OF NUMBERS; then study article in this connection.

Reduce the following fractions to higher terms: $\frac{1}{2}$, $\frac{5}{8}$, $\frac{2}{5}$, $\frac{5}{6}$, $\frac{7}{8}$.

Reduce the following fractions to 36ths: $\frac{1}{9}$, $\frac{1}{4}$, $\frac{2}{9}$, $\frac{3}{4}$, $\frac{5}{18}$, $\frac{5}{6}$.

Reduce the following fractions to 42nds: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{14}$, $\frac{3}{7}$, $\frac{5}{6}$, $\frac{2}{3}$, $\frac{9}{14}$, $\frac{6}{7}$, $\frac{3}{21}$.

Addition. (1) James has a pound of candy; he gives Alice $\frac{1}{4}$ of it; his mother $\frac{1}{4}$ of it, and eats $\frac{1}{4}$ of it himself. (a) What part of a lb. has he given away? (b) What part of a lb. is gone?

(a) $\frac{1}{4}$ lb.$+\frac{1}{4}$ lb.$=\frac{2}{4}$ lb.$=\frac{1}{2}$ lb.

(b) $\frac{1}{4}$ lb.$+\frac{1}{4}$ lb.$+\frac{1}{4}$ lb.$=\frac{3}{4}$ lb.; or, lb.$+\frac{1}{4}$ lb.$=\frac{3}{4}$ lb.

(2) Add \$$\frac{1}{5}$ and \$$\frac{3}{5}$.

\$$\frac{1}{5}$+\$$\frac{3}{5}$=\$$\frac{4}{5}$.

(3) A child gains $\frac{3}{4}$ lb. in weight one week and $\frac{3}{4}$ lb. the next week. What has he gained in all?

$\frac{3}{4}$ lb.$+\frac{3}{4}$ lb.$=\frac{6}{4}$ lb.$=\frac{3}{2}$ lb.

(4) On your ruler find the sum of $\frac{3}{8}$ in., $\frac{5}{8}$ in. and $\frac{7}{8}$ in.

$\frac{3}{8}$ in.$+\frac{5}{8}$ in.$+\frac{7}{8}$ in.$=\frac{15}{8}$ in.

(5) Add the following fractions; do not reduce the answers:

(a) $\frac{2}{9}+\frac{3}{9}+\frac{7}{9}+\frac{1}{9}+\frac{8}{9}=\frac{21}{9}$.
(b) $\frac{1}{4}+\frac{5}{8}+\frac{9}{8}+\frac{11}{8}+\frac{2}{8}=\frac{28}{8}$.
(c) $\frac{7}{24}+\frac{9}{24}+\frac{1}{24}+\frac{13}{24}+\frac{23}{24}=\frac{53}{24}$.

(6) Add the following fractions; reduce the answers:

(a) $\frac{3}{7}+\frac{1}{7}+\frac{9}{7}+\frac{9}{7}+\frac{3}{7}=\frac{21}{7}=3$.
(b) $\frac{5}{6}+\frac{3}{6}+\frac{7}{6}=\frac{15}{6}=\frac{5}{3}=2\frac{1}{3}$.
(c) $\frac{7}{10}+\frac{9}{10}+\frac{14}{10}=\frac{30}{10}=3$.

A whole number, as 3, is a more convenient form to think of, and to realize the value of, than such a fraction as $\frac{30}{10}$, and it is customary to change such fractions (those whose value is one or more than one) to whole or mixed numbers; as, $\frac{3}{2}=1\frac{1}{2}$, $\frac{9}{3}=3$, $\frac{28}{8}=3\frac{1}{2}$.

(7) Henry, Mary and Alice put their money together to buy a record for a victrola. Henry gave $\frac{1}{2}$ of the money and Mary $\frac{1}{4}$ of it. (a) What part did they together give?

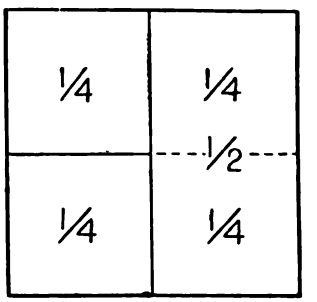


FIG. 8

$\frac{1}{2}$ of money$+\frac{1}{4}$ of money$=\frac{3}{4}$ of money.

(b) What part did Alice give?

Alice gave $\frac{1}{4}-\frac{3}{4}$ or $\frac{1}{4}$.

$\frac{1}{2}+\frac{1}{4}+\frac{1}{4}=\frac{4}{4}$. (See Fig. 8.)

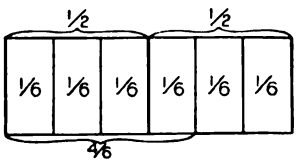


FIG. 9

(8) Add $\frac{1}{2}$ and $\frac{1}{6}$.

$\frac{1}{2}+\frac{1}{6}=\frac{3}{6}+\frac{1}{6}=\frac{4}{6}$. (See Fig. 9.)

(9) Add \$$\frac{1}{5}$ and \$$\frac{1}{10}$.

2 dimes$+1$ dime$=$\$$\frac{2}{10}$+\$$\frac{1}{10}$=\$$\frac{3}{10}$.

(10) Add $\frac{3}{8}$ and $\frac{3}{4}$.

$\frac{3}{8}+\frac{3}{4}=\frac{3}{8}+\frac{6}{8}=\frac{9}{8}$.

Unit of Measure. $\$\frac{3}{5}$ is 3 (one-fifth of a dollar); read, 3 times one-fifth of a dollar;

$\frac{7}{12}$ ft. is 7 (one-twelfth of a foot);

$\frac{2}{3}$ yd. is 2 (one-third of a yard);

$\frac{3}{4}$ bu. is 3 (one-fourth of a bushel);

$\frac{7}{8}$ lb. is 7 (one-eighth of a pound).

In the above, $\$\frac{1}{5}$, $\frac{1}{12}$ ft., $\frac{1}{3}$ yd., $\frac{1}{4}$ bu. and $\frac{1}{8}$ lb. are each the unit of measure, while 3, 7, 2, 3, and 7, the numerators, designate how many units of measure there are in the fraction under consideration. The unit of measure is called also the *fractional unit.*

Note the unit of measure, or fractional unit, in the following fractions:

Fractions	Unit of measure
$\frac{1}{6}$ lb.	$\frac{1}{6}$ lb.
$\frac{7}{8}$ yd.	$\frac{1}{8}$ yd.
$\frac{1}{6}$ lb.	$\frac{1}{6}$ lb.
$\$\frac{1}{5}$	$\$\frac{1}{5}$
$1\frac{1}{12}$ T.	$\frac{1}{12}$ T.
$\frac{7}{8}$ mi.	$\frac{1}{8}$ mi.
$\frac{3}{4}$ A.	$\frac{1}{4}$ A.

Fractions that have the same unit of measure are added very readily, as, $\frac{3}{4}$ in.$+\frac{3}{4}$ in.$=\frac{6}{4}$ in.; $\frac{1}{5}$ mi.$+\frac{3}{5}$ mi.$=\frac{7}{5}$ mi. Fractions which have not the same unit of measure must be changed, and expressed in terms of a common unit before they can be added, as, $\$\frac{3}{4}+\$\frac{7}{8}=\$\frac{6}{8}+\$\frac{7}{8}=\$13\frac{3}{8}$.

This is sometimes stated as follows: Fractions of different denominations must be reduced to the same denomination, or to a common denominator, before they can be added. In many cases we can see readily what this new denominator must be, as in adding $\frac{1}{4}$ and $\frac{1}{2}$, $\frac{1}{8}$ and $\frac{1}{2}$ and $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{4}$ and so on. Often we cannot see readily what this new denominator must be, but from what we have done above, in reducing fractions, we see that it must be a number which is divisible by each of the denominators of the fractions to be added. It is called a *multiple* of the denominators. (For further discussion of multiple, refer to LEAST COMMON MULTIPLE and study carefully in connection with this subject.)

In adding fractions we may use any common denominator, but it is desirable to use the smallest number that will serve the purpose; this is called the *least common denominator;* for example,

(a) $\frac{5}{24}+\frac{7}{8}+\frac{2}{3}=\frac{120}{576}+\frac{504}{576}+\frac{384}{576}=\frac{1008}{576}$

(b) $\frac{5}{24}+\frac{7}{8}+\frac{2}{3}=\frac{15}{72}+\frac{63}{72}+\frac{48}{72}=\frac{126}{72}$

(c) $\frac{5}{24}+\frac{7}{8}+\frac{2}{3}=\frac{5}{24}+\frac{21}{24}+\frac{16}{24}=\frac{42}{24}=\frac{7}{4}$

$\frac{1008}{576}=\frac{42}{24}=\frac{7}{4}$

$\frac{126}{72}=\frac{42}{24}=\frac{7}{4}$

In (a) and (b) the common denominators are larger than in (c), where the least common denominator is used. We see that (c) is the simplest solution.

Add $\frac{1}{8}$, $\frac{3}{5}$, $\frac{5}{6}$. The least common denominator is 120.

$1=\frac{120}{120}$

$\frac{1}{8}=\frac{1}{8}$ of $\frac{120}{120}=\frac{15}{120}$

$\frac{1}{6}=\frac{1}{6}$ of $\frac{120}{120}=\frac{24}{120}$

$\frac{3}{5}=3\times\frac{24}{120}=\frac{72}{120}$

$\frac{1}{6}=\frac{1}{6}$ of $\frac{120}{120}=\frac{20}{120}$

$\frac{5}{6}=5\times\frac{20}{120}=\frac{100}{120}$

$\frac{1}{8}+\frac{3}{5}+\frac{5}{6}=\frac{15}{120}+\frac{72}{120}+\frac{100}{120}=\frac{187}{120}$

We may also look at the reduction in this way: By what number must both terms of $\frac{1}{8}$ be multiplied so that it will be expressed in 120ths? By what number must both terms of $\frac{3}{5}$ be multiplied, and so on, as seen below:

$\frac{1}{8}=\frac{n}{120}$ $\qquad \frac{1\times 15}{8\times 15}=\frac{15}{120}$

$\frac{3}{5}=\frac{n}{120}$ $\qquad \frac{3\times 24}{5\times 24}=\frac{72}{120}$

$\frac{5}{6}=\frac{n}{120}$ $\qquad \frac{5\times 20}{6\times 20}=\frac{100}{120}$

8 must be multiplied by 15 to produce 120, and so *both terms* of the fraction must be multiplied by 15 to reduce it to 120ths. The same analysis holds for $\frac{3}{5}$ and $\frac{5}{6}$.

Add $\frac{20}{63}$, $\frac{7}{72}$, $\frac{5}{36}$.

(a) Find the least common denominator, which is the least common multiple of 63, 72 and 36, or 504.

(b) $\frac{20\times 8}{63\times 8}=\frac{160}{504}$

$\frac{7\times 7}{72\times 7}=\frac{49}{504}$

$\frac{5\times 14}{36\times 14}=\frac{70}{504}$

$\frac{279}{504}=\frac{31}{56}$

Mixed Numbers. Dan has \$6 in his bank, and \$.75 in his pocket. He has altogether \$6.75 or $\$6\frac{3}{4}$. John measured his father. He found him to be 5 feet and 9 inches tall. He is $5\frac{3}{4}$ feet tall. $\$6\frac{3}{4}$ and $5\frac{3}{4}$ feet, and all such numbers made up of a whole number and a fraction, are called *mixed numbers* (see Fig. 10).

Addition of Mixed Numbers. Sarah has $4\frac{5}{8}$ yd. of ribbon in one piece and $6\frac{1}{2}$ yd. in another. How much has she in all?

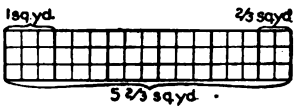


FIG. 10

$4\frac{5}{8}$ yd.$+6\frac{1}{2}$ yd.$=4\frac{5}{8}$ yd.$+6\frac{4}{8}$ yd.$=10\frac{9}{8}$ yd.

Add $7\frac{2}{5}$, $9\frac{1}{3}$, $16\frac{3}{4}$.

$7\frac{2}{5}=7\frac{24}{60}$

$9\frac{1}{3}=9\frac{20}{60}$

$16\frac{3}{4}=16\frac{45}{60}$

$32\frac{89}{60}=33\frac{29}{60}$

To add mixed numbers, find the sum of the whole numbers; find the sum of the fractions, and combine the results. Answers in addition of fractions and of mixed numbers should be reduced to their simplest forms.

Subtraction of Fractions. (1) Jane has $\frac{7}{8}$ of a yard of flowered ribbon. She cut off $\frac{3}{8}$ of a yard for her doll's skirt; $\frac{2}{8}$ of a yard for her jacket, and made a pretty hand-bag out of what was left. (a) How much did she have left after the skirt was cut off? (b) How much did she have for the hand-bag?

(a) $\frac{7}{8}$ yd. $-\frac{3}{8}$ yd. $=\frac{4}{8}$ yd. $=\frac{1}{2}$ yd.
(b) $\frac{4}{8}$ yd. $-\frac{2}{8}$ yd. $=\frac{2}{8}$ yd. $=\frac{1}{4}$ yd.
(See Fig. 11.)

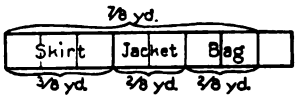


FIG. 11

(2) Subtract (a) $\frac{1}{4}$ from $\frac{3}{4}$; (b) $\frac{1}{8}$ from $\frac{5}{8}$; (c) $\frac{1}{6}$ from $\frac{5}{6}$; (d) $\frac{2}{5}$ from $\frac{4}{5}$; (e) $\frac{2}{9}$ from $\frac{7}{9}$.

(a) $\frac{3}{4}-\frac{1}{4}=\frac{2}{4}$
(b) $\frac{5}{8}-\frac{1}{8}=\frac{1}{2}$
(c) $\frac{5}{6}-\frac{1}{6}=\frac{1}{6}$
(d) $\frac{4}{5}-\frac{2}{5}=\frac{2}{5}$
(e) $\frac{7}{9}-\frac{2}{9}=\frac{5}{9}$

(3) Mr. Stevens owned $\frac{37}{64}$ of a section of land; he sold to Mr. Miles $\frac{19}{64}$ of a section. (a) What part of a section had he left? (b) How much more land had Mr. Miles, then, than Mr. Stevens?

(a) $\frac{37}{64}$ section $-\frac{19}{64}$ section $=\frac{18}{64}$ section
(b) $\frac{19}{64}$ section $-\frac{18}{64}$ section $=\frac{1}{64}$ section. (See Fig. 12.)

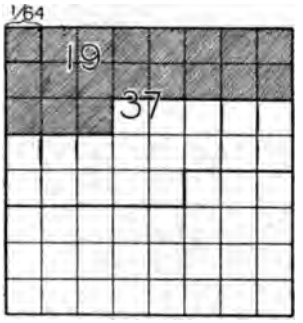


FIG. 12

(4) A train ran $\frac{2}{3}$ of a mile the first minute, $\frac{5}{6}$ of a mile the second. What was the increase of speed the second minute?

$\frac{5}{6}$ mi. $-\frac{2}{3}$ mi. $=\frac{5}{6}$ mi. $-\frac{4}{6}$ mi. $=\frac{1}{6}$ mi.

(5) How much heavier is $\frac{7}{8}$ of a rectangular cake of candy than $\frac{2}{3}$ of it, the whole weighing one pound?

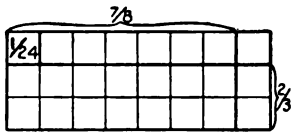


FIG. 13

$\frac{7}{8}$ lb. $-\frac{2}{3}$ lb. $=2\frac{1}{24}$ lb. $-1\frac{16}{24}$ lb. $=\frac{5}{24}$ lb. (See Fig. 13.)

(6) $\frac{7}{9}-\frac{2}{3}=n$.
$\frac{7}{9}-\frac{3}{3}=\frac{7}{9}-\frac{6}{9}=\frac{1}{9}$

(7) $\frac{13}{15}-\frac{2}{3}=n$.
$\frac{13}{15}-\frac{3}{3}=\frac{13}{15}-\frac{10}{15}=\frac{3}{15}$

(8) $\frac{1}{6}-\frac{1}{8}=n$.
$\frac{1}{6}-\frac{1}{8}=\frac{4}{24}-\frac{3}{24}=\frac{1}{24}$. (See Fig. 14.)

(9) A woman buys $\frac{7}{8}$ of a pound of round steak. The bone weighs $\frac{3}{16}$ of a pound. How much meat has she?

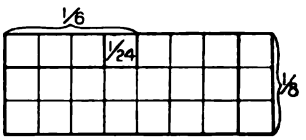


FIG. 14

$\frac{7}{8}$ lb. $-\frac{3}{16}$ lb. $=1\frac{4}{16}$ lb. $-\frac{3}{16}$ lb. $=1\frac{1}{16}$ lb.

(10) $\frac{7}{16}-\frac{3}{8}=n$
$\frac{7}{16}-\frac{6}{16}=\frac{1}{16}$.

(11) $\frac{5}{8}-\frac{1}{16}=n$
$\frac{10}{16}-\frac{1}{16}=\frac{9}{16}$.

(12) $\frac{9}{16}-\frac{1}{4}=n$
$\frac{9}{16}-\frac{4}{16}=\frac{5}{16}$.

(1) *When fractions have the same unit of measure subtract the numerator of the subtrahend from that of the minuend, as in the first set of problems given above.*

(2) *When fractions have not the same unit of measure express them in terms of the same unit or in terms of their least common denominator and subtract as in 1.*

Addition and Subtraction of Unit Fractions. A fraction whose numerator is 1 is called a *unit fraction*, as, $\frac{1}{2}$, $\frac{1}{3}$.

$$\frac{1}{2}+\frac{1}{3}=\frac{3}{6}+\frac{2}{6}=\frac{3+2}{6}=\frac{5}{6}$$

$$\frac{1}{5}+\frac{1}{2}=\frac{2}{10}+\frac{5}{10}=\frac{2+5}{10}=\frac{7}{10}$$

$$\frac{1}{4}+\frac{1}{3}=\frac{4+3}{4\times 3}=\frac{7}{12}$$

$$\frac{1}{5}+\frac{1}{3}=\frac{3+5}{5\times 3}=\frac{8}{15}$$

$$\frac{1}{7}+\frac{1}{6}=\frac{7+6}{7\times 6}=\frac{13}{42}$$

$$1/a+1/n=\frac{n+a}{n\times a}$$

The sum of two unit fractions is the sum of the denominators over the product of the denominators.

$$\frac{1}{2}-\frac{1}{3}=\frac{3-2}{3\times 2}=\frac{1}{6}$$

$$\frac{1}{2}-\frac{1}{5}=\frac{5-2}{2\times 5}=\frac{3}{10}$$

$$\frac{1}{3}-\frac{1}{4}=\frac{4-3}{4\times 3}=\frac{1}{12}$$

$$\frac{1}{6}-\frac{1}{7}=\frac{7-6}{7\times 6}=\frac{1}{42}$$

$$1/a-1/b=\frac{b-a}{a\times b}$$

The difference between two unit fractions is the difference between the denominators over the product of the denominators.

Subtraction of Mixed Numbers. (1) From a bucket of candy weighing $19\frac{13}{16}$ lbs., a box weighing $7\frac{7}{16}$ lbs. was filled; how much candy was left in the bucket?

$$19\tfrac{13}{16} \text{ lb.} - 7\tfrac{7}{16} \text{ lb.} = 12\tfrac{11}{16} \text{ lb.}$$

(2) From $5\frac{9}{16}$ subtract $3\frac{1}{16}$.

$$5\tfrac{9}{16} - 3\tfrac{1}{16} = 2\tfrac{8}{16}$$

(3) From $12\frac{1}{5}$ subtract $9\frac{1}{5}$.

$$12\tfrac{1}{5} - 9\tfrac{1}{5} = 3\tfrac{0}{5}$$

(4) From $9\frac{0}{7}$ subtract $4\frac{3}{7}$.

$$9\tfrac{0}{7} - 4\tfrac{3}{7} = 5\tfrac{4}{7}$$

When the fraction in the subtrahend is larger than that in the minuend, there is another step in the process, as shown below.

(1) $28\frac{1}{3} - 12\frac{3}{5} = n$

$28\frac{1}{3} = 28\frac{5}{15} = 27 + (\frac{15}{15} + \frac{5}{15}) = 27\frac{20}{15}$

$12\frac{3}{5} = 12\frac{9}{15} = \qquad\qquad 12\ \frac{9}{15}$

$\qquad\qquad\qquad\qquad\qquad\qquad 15\frac{11}{15}$

We cannot take $\frac{9}{15}$ out of $\frac{5}{15}$, so we take 1 out of 28 and reduce it to $\frac{15}{15}$ and combine this with the $\frac{5}{15}$; then we have $27\frac{20}{15}$. From this we subtract $12\frac{9}{15}$.

(2) From a fruit cake weighing $3\frac{2}{3}$ pounds, a baker cut $1\frac{3}{4}$ pounds. How much had he left?

$3\frac{2}{3}$ lb. $- 1\frac{3}{4}$ lb. $= 1\frac{11}{12}$ lb.

$3\frac{2}{3} = 3\frac{8}{12} = 2 + (\frac{12}{12} + \frac{8}{12}) = 2\frac{20}{12}$

$1\frac{3}{4} = 1\frac{9}{12} = \qquad\qquad 1\ \frac{9}{12}$

$\qquad\qquad\qquad\qquad\qquad\qquad 1\frac{11}{12}$

There is another method which is of sufficient interest to give it a place here, although it is not used generally. For example:

$$\begin{array}{r} 3\ \ \tfrac{2}{3} \\ -1\ \ \tfrac{3}{4} \\ \hline 1 + \tfrac{1}{4} + \tfrac{2}{3} = 1\tfrac{11}{12} \end{array}$$

Take 1 out of 3, leaving 2. Subtract the whole numbers and have 1; subtract $\frac{3}{4}$ from the 1 we took from 3 and have $\frac{1}{4}$. We still have $\frac{2}{3}$ in the minuend, and the answer is $1 + \frac{1}{4} + \frac{2}{3} = 1\frac{11}{12}$.

Use this method with the following:

$6\frac{1}{5}$	$19\frac{2}{3}$
$4\frac{2}{3}$	$15\frac{4}{5}$
$1\frac{1}{3} + \frac{1}{5} = 1\frac{8}{15}$	$3\frac{1}{5} + \frac{2}{3} = 3\frac{13}{15}$

Problems. 1. What is the distance around a room $14\frac{2}{3}$ feet long and $12\frac{3}{4}$ feet wide? How much longer is it than it is wide?

2. The ice froze $\frac{2}{3}$ inch one night, $\frac{3}{4}$ inch the next night, and $\frac{5}{8}$ inch the next night. How thick was the ice?

3. A farmer sent to town 3 loads of hay. One weighed $1\frac{3}{4}$ tons, another $1\frac{5}{8}$ tons and the other $1\frac{2}{3}$ tons. How many tons did he send in all?

4. Which load was the heaviest, and how much heavier than each of the others was it?

5. A boy buys papers at $1\frac{2}{5}$¢ each, and sells them at 2¢ each. How much does he make on 25 papers?

Multiplication of Fractions. The first process is the multiplication of a fraction by a whole number.

(1) A newsboy makes $\frac{3}{5}$¢ on each paper he sells. He sells 12 papers in ½ hour. He makes $12 \times \frac{3}{5}$¢ or $2\frac{4}{5}$¢. One evening he sold 60 papers. He made $60 \times \frac{3}{5}$¢ or $\frac{180}{5}$¢ or 24¢.

(2) A school-store dealer bought 1 dozen pencils at $\frac{5}{6}$¢ for each pencil. He spent $12 \times \frac{5}{6}$¢ or $\frac{60}{6}$¢ or 7½¢.

(3) $8 \times \frac{3}{5} = \frac{8 \times 2}{5} = \frac{16}{5} = 3\frac{1}{5}$

(4) $9 \times \frac{4}{7} = \frac{9 \times 4}{7} = \frac{36}{7} = 5\frac{1}{7}$

(5) $6 \times \frac{5}{12} = \frac{\overset{1}{\cancel{6}} \times 5}{\underset{2}{\cancel{12}}} = \frac{5}{2} = 2\frac{1}{2}$

(6) $24 \times \frac{5}{8} = \frac{\overset{4}{\cancel{24}} \times 5}{\underset{1}{\cancel{8}}} = 20$

(7) $27 \times \frac{4}{9} = \frac{\overset{3}{\cancel{27}} \times 4}{\underset{1}{\cancel{9}}} = 12$

Cancel when possible to shorten the work. Reduce answers to whole or mixed numbers.

(8) $\frac{2}{3}$ of $27 = \frac{2 \times \overset{9}{\cancel{27}}}{\underset{1}{\cancel{3}}} = 18$

(9) $\frac{7}{8}$ of $40 = \frac{7 \times \overset{5}{\cancel{40}}}{\underset{1}{\cancel{8}}} = 35$

(10) $\frac{2}{3}$ of $16 = \frac{2 \times 16}{3} = \frac{32}{3} = 10\frac{2}{3}$

Taking a fractional part of a number, as $\frac{2}{3}$ of 27, is called *multiplication of a whole number by a fraction.* But this is the same as multiplication of a fraction by a whole number, and the processes are the same as shown above.

The next step is multiplication of a fraction by a fraction, as ½ of ⅓. This process is illustrated in Fig. 15.

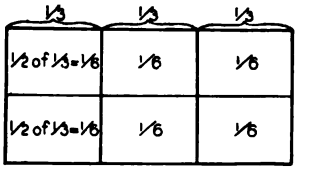


FIG. 15

(a) $\frac{1}{4}$ of $\frac{1}{5} = \frac{1}{20}$

(b) $\frac{3}{4}$ of $\frac{1}{5} = \frac{3}{20}$

(c) $\frac{3}{4}$ of $\frac{2}{5} = \frac{6}{20}$

(d) $\frac{3}{4}$ of $\frac{3}{5} = \frac{9}{20}$

Study Fig. 16. Note that each of the small divisions is equal to the product of ¼ by ⅕.

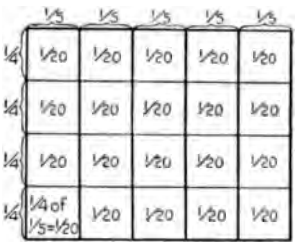


FIG. 16

$$\tfrac{7}{8} \text{ of } 1\tfrac{9}{21} = \tfrac{7}{8} \times 1\tfrac{9}{21} = \frac{\overset{1}{\cancel{7}} \times \overset{2}{\cancel{16}}}{\underset{1}{\cancel{8}} \times \underset{3}{\cancel{21}}} = \tfrac{2}{3}$$

$$1\tfrac{14}{17} \times 3\tfrac{3}{17} = \frac{\overset{2}{\cancel{31}} \times \overset{2}{\cancel{34}}}{\underset{1}{\cancel{17}} \times \underset{1}{\cancel{2}}} = 4$$

Cancel when possible, as above.

Then follows the multiplication of mixed numbers.

(1) A farmer sells milk at 8⅓ cents a quart. He sells 9 quarts one day. What are his receipts?

He receives for his milk $9 \times 8\frac{1}{3}¢$ or 75¢. $(9 \times 8) + (9 \times \frac{1}{3}) = 72 + 3 = 75$.

(2) What will 13 feet of hose cost at $16\frac{2}{3}¢$ per foot?

$$\text{Cost} = 13 \times 16\tfrac{2}{3}¢ = 216\tfrac{2}{3}¢$$

$$\begin{array}{r} 16\frac{2}{3} \\ 13 \\ \hline 48 \\ 16 \\ \hline 208\frac{2}{3} \end{array} = 216\tfrac{2}{3}$$

(3) What is the area of a flower-bed 5 feet long and 3¾ feet wide? (See Fig. 17.)

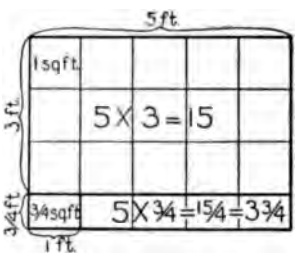


FIG. 17

Length = 5 ft.
Width = 3¾ ft.
Area in sq. ft. = $5 \times 3\frac{3}{4} = 18\frac{3}{4}$

Construct other diagrams similar to the one shown in Fig. 17, showing the methods of solution of the following problems:

$3 \times 4\frac{1}{4}$
$7 \times 6\frac{2}{3}$

(4) How many square yards in a floor $6\frac{2}{3}$ yards long and $5\frac{1}{2}$ yards wide? (See Fig. 18.)

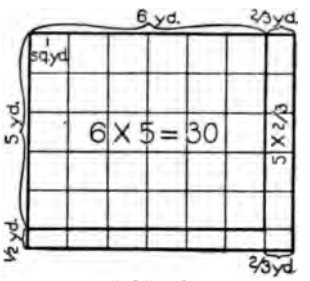


FIG. 18

Length = $6\frac{2}{3}$ yd.
Width = $5\frac{1}{2}$ yd.
Area in sq. yd. = $(6 \times 5) + (6 \times \frac{1}{2}) + (5 \times \frac{2}{3}) + (\frac{1}{2} \times \frac{2}{3})$
Area in sq. yd. = $30 + 3 + 3\frac{1}{3} + \frac{1}{3} = 36\frac{2}{3}$

The full process is shown below:

$$\begin{array}{r} 6\frac{2}{3} \\ 5\frac{1}{2} \\ \hline 30 \\ 3\frac{1}{3} \\ 3 \\ \frac{1}{3} \\ \hline 36\frac{2}{3} \end{array}$$

$8\frac{2}{5} \times 4\frac{1}{2} = n$

$$\begin{array}{r} 8\frac{2}{5} \\ 4\frac{1}{2} \\ \hline 32 \\ 1\frac{3}{5} \\ \frac{4}{5} \\ \hline 37\frac{4}{5} \end{array}$$

(1) $4 \times 8 = 32$
(2) $4 \times \frac{2}{5} = 1\frac{3}{5}$
(3) $\frac{1}{2} \times 8 = 4$
(4) $\frac{1}{2} \times \frac{2}{5} = \frac{1}{5}$

A mixed number is multiplied by a mixed number in another way, namely, by *reducing both mixed numbers to fractions, and multiplying;* for example, $8\frac{2}{5} \times 4\frac{1}{2} = \frac{\overset{21}{\cancel{42}}}{5} \times \frac{9}{\underset{1}{\cancel{2}}} = \frac{189}{5} = 37\frac{4}{5}$.

Division of a Fraction by a Whole Number. (1) ¾ of an acre of land is to be planted in lettuce, onions and radishes, giving to the vegetables equal spaces. What amount of land is planted in each?

⅓ of ¾ A. = ¼ A., or ¾ A. $\div 3 = \frac{1}{4}$ A.

(2) A man gives his wife ⅜ of his fortune, and divides the rest equally between his two sons. What part of the fortune does each son receive?

½ of ⅜ = 3/16, or ⅜ ÷ 2 = 3/16.
¼ of ⅝ = 5/32, or ⅝ ÷ 4 = 5/32.
⅓ of $1\frac{1}{19} = \frac{3}{19}$, or $1\frac{1}{19} \div 7 = \frac{3}{19}$

½ of ⅓ = 1/14;	½ of 3/7 = 3/14
⅓ ÷ 2 = 1/14;	3/7 ÷ 2 = 3/14
¼ of ⅕ = 1/20;	¼ of ⅝ = 5/32
⅕ ÷ 4 = 1/20;	⅝ ÷ 4 = 5/32

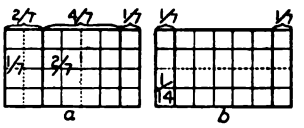


FIG. 19

See that ½ of 2/7 = 1/7
½ of 1/7 = 2/7. (Fig. 19, *a*.)
See that ½ of 1/7 = 1/14. (Fig. 19, *b*.)
½ of 3/7 = 3/14
½ of 3/7 = $\frac{1\frac{1}{2}}{7}$
½ of 5/7 = 5/14
½ of 5/7 = $\frac{2\frac{1}{2}}{7}$

To divide a fraction by a whole number (1) divide the numerator by the integer; as, 4/7 ÷ 2 = 2/7; or ***(2) Multiply the denominator by the integer;*** as, 5/7 ÷ 2 = 5/14. We use the first method when the numerator is *divisible* by the integer, but either method may be used with any fraction; for example, 4/7 ÷ 2 = ½ of 4/7 = 4/14 = 2/7; 5/7 ÷ 2 = $\frac{2\frac{1}{2}}{7}$, which reduced equals 5/14.

It is simple in both cases to look upon the problem as finding a fractional part of a fraction; as,

½ ÷ 2 = ½ of ⅛ = 1/16
⅕ ÷ 3 = ⅓ of ⅕ = 1/15
$\frac{1}{7} \div 14 = \frac{1}{14} \text{ of } \frac{1}{7} = \frac{1}{98}$
$\frac{3}{17} \div 10 = \frac{1}{10} \text{ of } \frac{3}{17} = \frac{3}{34}$

Division of a Mixed Number by a Whole Number. (1) A housekeeper has a piece of tapestry 6⅔ feet long for two draperies. How long can she make them?

½ of 6⅔ ft. = 3⅓ ft.
6⅔ ft. ÷ 2 = 3⅓ ft.

(2) Jane divides a Christmas ribbon 8⅞ yards long into four equal pieces. How long is each? (See Fig. 20.)

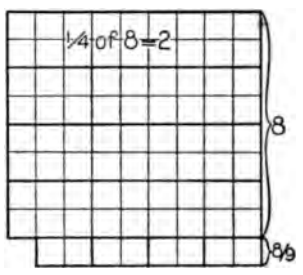


FIG. 20

¼ of 8⅞ yd. = 2⅛ yd. 8⅞ ÷ 4 = 2⅛

Make other diagrams showing methods of solving similar problems.

(3) 10⅝ ÷ 5 = *n*.

10⅝ ÷ 5 = 2⅛. (Fig. 21.)

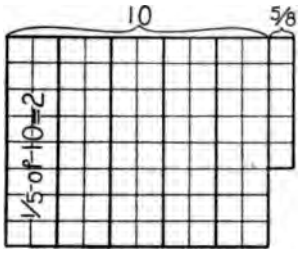


FIG. 21

From the above problems the following rule may be deduced:

To divide a mixed number by an integer, when the integer of the mixed number is divisible by the divisor, divide it, and then divide the fractional part of the mixed number by the divisor, and combine the two answers.

(1) 17½ ÷ 5 = *n*

5 | 17½
$3\frac{2\frac{1}{2}}{5} = 3\frac{1}{2}$

(2) 15⅞ ÷ 7 = $2\frac{1\frac{7}{8}}{7} = 2\frac{15}{56}$

(3) 825¾ ÷ 45 = *n*

$18\frac{15\frac{3}{4}}{45} = 18\frac{7}{20}$

45 | 825¾
45
375
360
15¾

$\frac{15\frac{3}{4} \times 4}{45 \times 4} = \frac{63}{180} = \frac{7}{20}$

(4) 152⅜ ÷ 16 = *n*

$9\frac{8\frac{3}{8}}{16} = 9\frac{1}{3}\frac{3}{2}\frac{1}{4}$

16 | 152⅜
144
8⅜

$\frac{8\frac{3}{8} \times 3}{16 \times 3} = \frac{25}{48} = \frac{13}{24}$

In solving these four problems the following rule is applied:

Divide as in whole numbers, and reduce the complex fraction at the end.

A third method is shown in the following rule:

Reduce the mixed number to a fraction, and divide; as, 1⅛ ÷ 3 = 9/8 ÷ 3 = 3/8; 7/18 ÷ 18 = 1/18 of 6⅞ = 7/162.

Solve the following:

1. ⅛ of 16/19 = *n*
2. 5/7 ÷ 2 = *n*
3. 5/12 ÷ 5 = *n*
4. 1/7 of 14/31 = *n*
5. ¼ of 5/9 = *n*
6. 12/25 ÷ 24 = *n*
7. 3/19 ÷ 78 = *n*
8. 12⅜ qt. ÷ 19 = *n*
9. 9⅜ mi. ÷ 8 = *n*
10. 6⅔ ÷ 10 = *n*

11. A family uses 5⅝ pounds coffee in nine weeks. Find average used per week.
12. Find length of a rectangular floor 18 feet wide, whose area is 230½ square feet.
13. The following are the heights of 4 boys. Find their average height: 4½ feet, 4¾ feet, 5⅝ feet, 5½ feet.

Division by a Fraction. The following problems illustrate the principles involved in dividing numbers by fractions.

How many ⅓ feet in 1 foot? There are 3.

How many ⅓ feet in 2 feet? There are 2×3 or 6.

$1 \div \frac{1}{3} = 3$
$2 \div \frac{1}{3} = 2 \times 3 = 6$
$10 \div \frac{1}{3} = 10 \times 3 = 30$
$5\frac{1}{3} \div \frac{1}{3} = 5\frac{1}{3} \times 3 = 16$
$4\frac{1}{2} \div \frac{1}{3} = 4\frac{1}{2} \times 3 = 13\frac{1}{2}$

In 1 there are 3 one-thirds. In 2 there are 2 times as many one-thirds as in 1, or 2×3 or 6. In 5⅓ there are 5⅓ times as many one-thirds as in 1, or 5⅓×3 or 16. Such problems should be read, "How many ⅓'s in 1? In 2? In 10? In 5⅓?" Do not say, "1 divided by ⅓ equals what? 5⅓ divided by ⅓ equals what?" until the child is very familiar with division. The phrase "divide by" is a conventional expression which clouds the meaning of the question.

Fig. 22 (below) illustrates the number of ⅔'s and ⅓'s in ⅔'s.

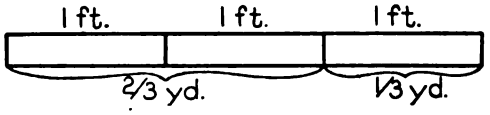


FIG. 22

(a) $1 \div \frac{2}{3} = 1\frac{1}{2}$
$3 \div \frac{2}{3} = 3 \times 1\frac{1}{2} = 4\frac{1}{2}$
$16 \div \frac{2}{3} = 16 \times 1\frac{1}{2} = 24.$

How many ⅖ mile in 1 mile? (See Fig. 23.)

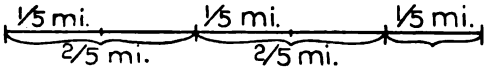


FIG. 23

There are 2½ *two-fifths miles* in 1 mile.

(b) $1 \div \frac{2}{5} = 2\frac{1}{2}$
$3 \div \frac{2}{5} = 3 \times 2\frac{1}{2} = 7\frac{1}{2}$
$16 \div \frac{2}{5} = 16 \times 2\frac{1}{2} = 40$

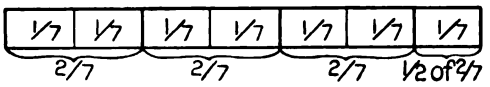


FIG. 24

(c) $1 \div \frac{2}{7} = 3\frac{1}{2}$
(d) $1 \div \frac{3}{4} = 1\frac{1}{3}$
(e) $1 \div \frac{1}{6} = 2\frac{1}{4}$

These processes may all be illustrated by drawings like Fig. 24, which applies to (c).

The answers above in (a), (b), (c), (d) and (e) may be shown as *fractions* instead of as mixed *numbers*, and we have:

$1 \div \frac{2}{3} = \frac{3}{2}$
$1 \div \frac{2}{5} = \frac{5}{2}$
$1 \div \frac{2}{7} = \frac{7}{2}$
$1 \div \frac{3}{4} = \frac{4}{3}$
$1 \div \frac{1}{6} = \frac{6}{1}$

From this may be deduced the rule:

1 divided by a fraction is the reciprocal of that fraction or the inverted form of that fraction.

$1 \div \frac{1}{6} = \frac{6}{1}$

$2 \div \frac{1}{6} = \frac{\overset{1}{2}}{1} \times \frac{6}{1} = \frac{12}{2} = 4\frac{1}{2}$

$20 \div \frac{1}{6} = \frac{\overset{5}{20}}{1} \times \frac{6}{1} = \frac{120}{1} = 45$

$6\frac{2}{3} \div \frac{1}{6} = 6\frac{2}{3} \times \frac{6}{1} = \frac{\overset{5}{20}}{3} \times \frac{\overset{2}{6}}{1} = \frac{40}{1} = 15$

$\frac{5}{6} \div \frac{1}{6} = \frac{5}{6}$ of $\frac{6}{1} = \frac{30}{2} = 15 = 1\frac{7}{8}$

$n \div \frac{1}{6} = n \times \frac{6}{1} = \frac{n \times 9}{4}$

Any number divided by a fraction equals that number times the reciprocal of the fraction.

We may solve the problem of dividing by a fraction in another way; namely, by changing the dividend and divisor to a *common denominator* or expressing them in terms of the same *fractional unit.*

$12 \div \frac{1}{3} = \frac{36}{3} \div \frac{1}{3} = 36$
$15 \div \frac{3}{8} = \frac{120}{8} \div \frac{3}{8} = 40$
$2\frac{2}{5} \div \frac{3}{4} = \frac{12}{5} \div \frac{3}{4} = \frac{48}{20} \div \frac{15}{20} = 3\frac{1}{5}$
$\frac{2}{9} \div \frac{5}{6} = \frac{4}{18} \div \frac{15}{18} = \frac{4}{15}$

Dividing by a Mixed Number. Division by a mixed number is explained by the following problems:

$6 \div 2\frac{1}{2} = 6 \div \frac{5}{2} = 6 \times \frac{2}{5} = \frac{12}{5} = 2\frac{2}{5}$

$6\frac{2}{3} \div 3\frac{1}{6} = 6\frac{2}{3} \div \frac{19}{6} = \frac{\overset{5}{20}}{3} \times \frac{6}{19} = \frac{25}{12} = 2\frac{1}{12}$

This division becomes division by a fraction, as soon as we reduce the divisor to a fraction.

Problems. (1) At ⅖¢ a piece, how many papers can a boy buy for 60¢?

Number of papers $= 60 \div \frac{2}{5} = \frac{\overset{30}{60}}{1} \times \frac{5}{2} = 150$

(2) Class badges are ⅜ yard long. How many badges can be supplied from a bolt (10 yards) of ribbon?

Number of badges $= 10 \div \frac{3}{8} = 10 \times \frac{8}{3} = \frac{80}{3} = 26\frac{2}{3}$. There are 26 badges and a piece of ribbon ⅔ as long as a badge.

(3) 16⅕ yards of silk are cut into remnants of 1⅘ yards each. How many remnants are there?

Number of remnants $= 16\frac{1}{5} \div 1\frac{4}{5} = \frac{81}{5} \div \frac{9}{5} = 9.$

(4) The circumference of a circle is, roughly, 3⅐ times as long as the diameter. The boys have a game ring whose circumference is $39\frac{17}{21}$ feet. What is its diameter?

(5) Matting ¾ yard wide is used to cover the floor of a hall 18 yards wide. How many strips are required?

(6) A rectangle has an area of $\frac{3}{20}$ square inch; it is ⅖ inch wide. How long is it?

(7) How many jugs each holding 1¾ gallons can be filled from a barrel (31½ gallons)?

Complex Fractions. Nellie has 3 pieces of ribbon each ½ yard long. She gives Sarah one-half of the ribbon by giving her one piece and half of another piece. Sarah now has $\frac{1\frac{1}{2}}{2}$ of a yard, and Nellie has left $\frac{1\frac{1}{2}}{2}$ of a yard (see Fig. 25).

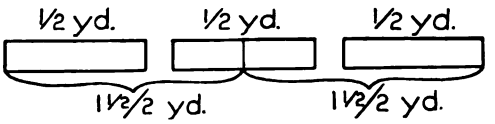


FIG. 25

A cake is cut by the baker into 8 equal parts. ⅜ is sold. Mrs. Hughes, going to the shop, buys ½ of what is left. What part of the cake does she get? She gets ½ of ⅝ or $\frac{2\frac{1}{2}}{8}$. What part of the cake is left? $\frac{2\frac{1}{2}}{8}$. (See Fig. 26.)

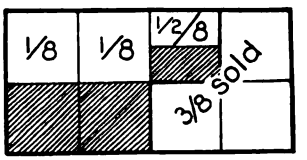


FIG. 26

½ of ⅞ = $\frac{3\frac{1}{2}}{8}$ ⅓ of ⅞ = $\frac{2\frac{1}{3}}{8}$

¼ of 9/10 = $\frac{2\frac{1}{4}}{10}$ 1/23 of 2 1/23 = $\frac{4\frac{2}{3}}{23}$

Study Fig. 27, below.

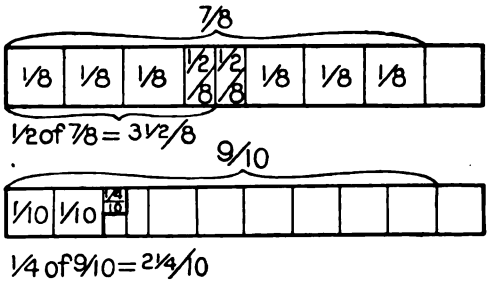


FIG. 27

Michael had $12 at Christmas. He spent $1 for a cap; $1½ for gloves for his mother; $3½ for shoes; $1¼ for neckties; $1¾ for candy, $3 for a turkey. What part of his money did he spend for each purchase?

Cost of cap = $\frac{1}{12}$ of his money

Cost of gloves = $\frac{1\frac{1}{2}}{12}$ " " "

Cost of shoes = $\frac{3\frac{1}{2}}{12}$ " " "

Cost of ties = $\frac{1\frac{1}{4}}{12}$ " " "

Cost of candy = $\frac{1\frac{3}{4}}{12}$ " " "

Cost of turkey = $\frac{3}{12}$ " " "

Cost of all = $\frac{12}{12}$ " " "

1 is what part of 7? Answer, ⅐.

2 is what part of 7? Answer, 2/7.

2½ is what part of 7? Answer, $\frac{2\frac{1}{2}}{7}$.

3⅛ is what part of 7? Answer, $\frac{3\frac{1}{8}}{7}$.

2½ months is what part of a year? Answer, $\frac{2\frac{1}{2}}{12}$.

6 mo. 10 da. is what part of a year? Answer, $\frac{6\frac{1}{3}}{12}$.

1 ft. 3 in. is what part of a yd.? Answer, $\frac{1\frac{1}{4}}{3}$.

2 pk. 3 qt. is what part of a bu.? Answer, $\frac{2\frac{3}{8}}{4}$.

Such fractions as those given above grew out of the conditions presented.

A fraction which has a fraction or a mixed number in either or both of its terms is called a complex fraction.

The complex fraction, despite its name, is a very simple and necessary tool in mathematics. It serves (1) to express *concisely* and readily *what* part one number is of another. For example, 1 ft. 9 in. is what part of 1 yd.? 9 in.=¾ ft. 1¾ ft.=$\frac{1\frac{3}{4}}{3}$ yd.

8 mo. 24 da. is what part of 1 yr.? Answer, $\frac{8\frac{1}{3}}{12}$.

When 8½ hr. is a day's work, what part of a day's wages should a man get who works 3¾ hr.? Answer, $\frac{3\frac{3}{4}}{8\frac{1}{2}}$.

The complex fraction serves (2) to express division. Divide 4⅝ yards of ribbon among 8 children. What part of a yard does each receive? Answer, $\frac{4\frac{5}{8}}{8}$.

A machine travels $2\frac{11}{12}$ miles in 2½ minutes. What is the rate per minute? Answer, $\frac{2\frac{11}{12}}{2\frac{1}{2}}$.

Reduction of Complex Fractions. The following problems illustrate the reduction of complex fractions:

$\frac{4\frac{5}{6}\times 6}{8\times 6}=\frac{29}{48}$ $\quad$ $\frac{2\frac{1}{2}\times 6}{4\frac{1}{3}\times 6}=\frac{15}{26}$

$\frac{2\frac{1}{2}\times 2}{7\times 2}=\frac{5}{14}$ $\quad$ $\frac{8\frac{1}{6}\times 10}{12\frac{1}{2}\times 10}=\frac{82}{125}$

$\frac{1\frac{1}{9}\times 9}{3\times 9}=\frac{10}{27}$ $\quad$ $\frac{4\times 7}{3\frac{1}{7}\times 7}=\frac{28}{22}=\frac{14}{11}$

$\frac{2\frac{3}{8}\times 8}{4\times 8}=\frac{19}{32}$ $\quad$ $\frac{16\times 3}{9\frac{2}{3}\times 3}=\frac{48}{29}$

$\frac{\frac{1}{2}\times 2}{15\times 2}=\frac{1}{30}$ $\quad$ $\frac{\frac{2}{5}\times 20}{\frac{3}{4}\times 20}=\frac{8}{15}$

To reduce a complex fraction to a simple fraction: (1) *Multiply both terms by a number that will rid numerator and denominator of fraction. The simplest such number is the least common denominator of these fractions.*

(2) *Divide numerator by denominator;* as,

$\frac{4\frac{1}{8}}{3}=33\frac{1}{8}\div 3=11\frac{1}{8}$; $\frac{6}{2\frac{2}{5}}=6\div 12\frac{1}{5}=\frac{\cancel{6}^{1}}{\cancel{12}_{2}}\times\frac{5}{\cancel{1}_{1}}=5\frac{1}{2}$;

$\frac{9\frac{1}{2}}{2\frac{5}{7}}=\frac{\cancel{19}^{1}}{\cancel{2}_{1}}\times\frac{7}{\cancel{5}_{1}}=7\frac{1}{2}$.

(3) *Divide numerator and denominator by the same number; as,*

$\frac{2\frac{1}{2}\div 2\frac{1}{2}}{5\div 2\frac{1}{2}}=\frac{1}{2}$ $\quad$ $\frac{7\frac{1}{2}\div 2\frac{1}{2}}{12\frac{1}{2}\div 2\frac{1}{2}}=\frac{3}{5}$

$\frac{4\frac{1}{2}\div 4\frac{1}{2}}{13\frac{1}{2}\div 4\frac{1}{2}}=\frac{1}{3}$ $\quad$ $\frac{12\frac{1}{2}\div 12\frac{1}{2}}{37\frac{1}{2}\div 12\frac{1}{2}}=\frac{1}{3}$

A more complicated form of complex fractions is seen in such expressions as $\frac{2\frac{1}{2}+\frac{2}{3}}{3\frac{1}{2}-1\frac{1}{3}}$. This is simplified by multiplying both terms by the same number: $\frac{2\frac{1}{2}+\frac{2}{3}\times 6}{3\frac{1}{2}-1\frac{1}{3}\times 6}=\frac{15+4}{21-2}=\frac{19}{19}=1$. The third method is not generally applicable, as the divisor is not always apparent. The first method is generally the most satisfactory.

Problems. (1) 6 lb. 8 oz. is what part of 20 lb.? The part $=\frac{6\frac{1}{2}}{20}=13\frac{1}{40}$.

(2) Three ladies divided a bolt of ribbon (10 yd.) in this way: Mrs. R. took 3¾ yd., Mrs. M. took 4½ yd. and Mrs. Y. took 1¾ yd. For what part of the bolt should each one pay?

Mrs. R's part $=\frac{3\frac{3}{4}}{10}=15\frac{1}{40}=\frac{3}{8}$

Mrs. M's part $=\frac{4\frac{1}{2}}{10}=\frac{9}{20}$

Mrs. Y's part $=\frac{1\frac{3}{4}}{10}=\frac{7}{40}$

(3) When a working day is 7½ hr., and the wages are $4.50, how much does a man lose who is off duty 1½ hr.? Loss $=\frac{1\frac{1}{2}}{7\frac{1}{2}}$ of $4.50 $=\frac{1}{5}$ of $4.50 $=$.90.

(4) A piece of fine lace 21¼ inches long is marked to sell for $17. What part of the strip is 15 inches? How much would it cost?

(5) $2\frac{3}{5}\div 9\frac{3}{4}=\frac{2\frac{3}{5}}{9\frac{3}{4}}=n$.

(6) $\frac{2\frac{1}{2}}{3\frac{1}{3}}=n$.

(7) 6 months and 12 days is what part of a year? $\frac{6\frac{2}{5}}{12}=\frac{32}{60}=\frac{8}{15}$.

(8) 9 months and 20 days is what part of a year?

(9) If the interest on $8000 is $480 for a year, what should it be for 9 months and 20 days?

A Fraction as an Expressed Division. (1) Divide $2 equally among three men. What does each receive? Answer, $⅔. This fraction $⅔ shows that $2 is divided into 3 equal parts, and each part is $⅔.

(2) Divide 5 yards of ribbon among 8 girls equally. This division is indicated by ⅝ yard. In ⅝ yard we see also what each girl receives; namely, ⅝ yard.

So a fraction is an (a) *indicated division,* and (b) the *answer to such division.*

$7\div 8=\frac{7}{8}$
$13\div 4=13\frac{1}{4}$
$5\div 7=\frac{5}{7}$
$200\div 4=200\frac{1}{4}$

The expression of division by the division sign (÷) should give way generally to the fraction form because (a) of its more concise form; and because (b) the quotient becomes evident as the problem is set down; for example, $2\div 9$, ⅔.

Part Given to Find the Whole. Note in Fig. 28 that we have indicated the five equal parts of a whole.

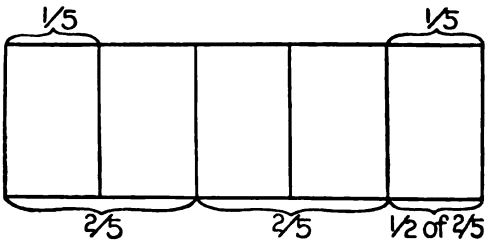


FIG. 28

⅖ of a bolt of linen is worth $19. What is it all worth?

From the above drawing we see that a whole bolt would be 2½ times as large as ⅖ of the bolt.

Solution:

Cost of ⅖ of bolt $=$ $19
Cost of bolt $=2\frac{1}{2}\times$ $19 $=$ $47½

Make a drawing, and show how many times one acre is as large as 3/16 of an acre. It is 5⅓ times as large.

$\frac{3}{16}$ of an acre of town land sold for $1650. At this rate what will an acre sell for?

Solution:

Cost of $\frac{3}{16}$ acre = $1650
Cost of 1 acre = $5\frac{1}{3} \times \$1650 = \$8800$

Or we may change the mixed number to a fraction and the first problem will appear thus:

Cost of $\frac{2}{5}$ bolt = $19
Cost of bolt = $\frac{1}{2} \times \$19 = \$9\frac{1}{2} = \$47\frac{1}{2}$

Such problems may also be analyzed through the fractional unit, as follows:

Cost of $\frac{2}{5}$ bolt = $19
Cost of $\frac{1}{5}$ bolt = $\$19 \div 2 = \$9\frac{1}{2}$
Cost of bolt = $5 \times \$9\frac{1}{2} = \$47\frac{1}{2}$
Cost of $\frac{3}{16}$ acre = $1650
Cost of $\frac{1}{16}$ acre = $\$1650 \div 3 = \$550$
Cost of 1 acre = $16 \times \$550 = \$8800$. A.H.

FRACTURE, *frak'ture,* a word taken from a Latin word meaning *break,* and used commonly to designate the breaking of a bone. There is the *simple* fracture, in which there is no communication between the broken bone and the outer air; the *compound* fracture, in which there does exist such communication; the *multiple* form, in which there is more than one break; the *comminuted,* in which the bone is splintered; and several others. Fractures may occur at any age, but the bones of very young persons and of very old persons are far more fragile and liable to breakage than are those of strong persons in middle life.

Many fractures are easily detected. There is intense pain, soreness or tenderness; swelling; an abnormal point of motion; and, when the ends of the bones are rubbed together, a curious crackling. In some bones, however, not all these symptoms can be detected after breakage, and only surgical examination or the X-ray can reveal the fracture. No one but a surgeon should attempt to reduce a fracture, and all that can be done until the arrival of a surgeon is to prevent any motion of the injured part.

FRA DIAVOLO, *frah de ah'vo lo* (?1770-1806), the popular name given to MICHELE PEZZA, an Italian bandit who was born at Calabria. As the leader of a band of desperadoes in the mountains of Calabria, he terrorized the entire country by his daring attacks and robberies. His barbarous cruelties and the fact that he had originally been a monk gained him the name of *Fra Diavolo,* which is Italian for *brother devil.* He was made a colonel by Ferdinand of Naples, with whom he united against the French. He was afterwards convicted of inciting a rebellion and was executed. Auber's opera, *Fra Diavolo,* is founded upon Pezza family traditions, but is not intended to be historically accurate.

FRAMINGHAM, *fraym'ing ham,* MASS., a city of Middlesex County, including within its limits the villages of Framingham Center, South Framingham, Saxonville and Nobscot. The Federal census of 1910 and an estimate in 1916 reported 12,948 and 13,982 inhabitants, respectively. The city is located in the central-eastern part of the state, twenty-one miles west of Boston, twenty-three miles northeast of Worcester and twenty-five miles south of Lowell. It is on the New York, New Haven & Hartford and the Boston & Albany railroads.

Framingham is the seat of a state normal school, the first in the United States, which was established at Lexington in 1839, removed to Newton in 1844, and to its present site in 1853. It also has an historical and natural history society, a library, one public and three private hospitals, an almshouse and a home for the aged. In 1916 the erection of a new Federal building was begun.

South Framingham is the principal business and banking center. It has large manufactories of paper tags, crepe paper, gummed labels, paper boxes, boots and shoes, and rubber and straw goods. Woolen yarns, wool blankets and worsted cloths are manufactured in Saxonville. Stoves, plows, steam boilers and farming implements are among the numerous other manufactures. The Dennison Tag Company has more than 2,500 employees.

Framingham was first settled about 1640. It was named in honor of Framlingham, the English home of Governor Thomas Danforth. He once owned the land upon which the settlement was made, and the town was called Danforth's Plantation until 1700, when it was incorporated under its present name. R.E.K.

FRANC, *frank,* a silver coin adopted in 1795 as the monetary unit of France, in the same sense that the dollar is the unit of United States and Canada money. It is equivalent to 19.3 cents. The franc is divided into 100 centimes, but the smallest coin in circulation in France is the five centime piece, called a *sou.* Silver coins of five, two, one and half a franc are still in use, though gold is the standard, represented by coins of ten and twenty francs. Practically the same coin has been adopted as the monetary unit of Italy, where it is called a *lira;* of Greece, where it is known as a *drachma;* and also of Belgium, where the French term *franc* is used.

good harbors, Toulon, Cannes and Nice. It is this shore region, where the Alps run down almost to the sea and leave but a narrow strip, bright with sun and overgrown with almost tropic vegetation, which bears the name of the *Riviera,* and is one of the most popular resort regions of Europe.

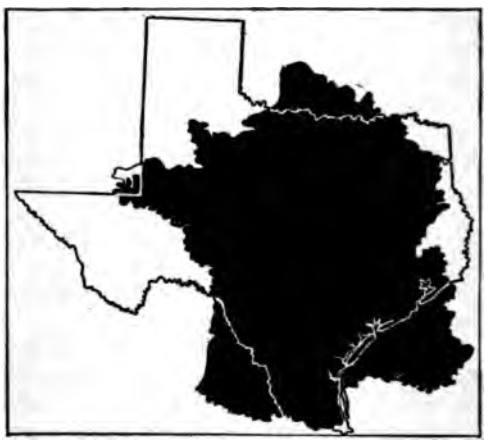
The western part of the Mediterranean coast, comprising the great sweeping Gulf of the Lion, is inhospitable, either by reason of rocks or of sandy dunes, and the southern part of the Atlantic seaboard, on the west, affords no harbors. Farther north is an island-fringed shore with occasional harbors, while in the northwest is the Breton "savage coast," as it is called, which hurls back the sea from its rocky cliffs. On the north the chief port is Cherbourg, on the peninsula of Cotentin in Normandy, with its breakwater-protected harbor, a great port of call for ocean steamships.

Highlands and Lowlands. France has some of the highest peaks of Europe and some, or at least one, of the most famous in the world (see below), but these are all on the border lines and are thus not dominating features of the landscape. Very simply stated, France consists of a northern and western lowland section; a south-central plateau; and, in the south and southeast highland regions sloping toward the Pyrenees and the Alps. Between the great plateau and the Alps runs the deep valley of the Rhone. The average height of the country above sea level is about 1,000 feet.

Considerably below this average is the northern and western plain, which has a mean elevation of somewhat less than 650 feet. It is broken by a few hilly tracts in Brittany and Normandy, nowhere over 1,400 feet in altitude, and by occasional rounded hillocks called *bocages,* or groves, because of the trees which cover them. The south-central plateau is a region of intermittent highlands and old volcanic mountains, known as the Cévennes (which see). Its greatest elevation, Mont Dore, is 6,188 feet, and it slopes gradually toward the northwest, melting at last into the plain of the north and west. If the ocean were to rise 660 feet, the northern and western limits of this plateau region would form the Atlantic seacoast of France, with only occasional islands at some distance from the shore.

There are picturesque regions in the plateau [illegible]untry, rich plains and beautiful vineyard-[illegible] valleys in the lowland country, but the [illegible]derful beauties of France are on its frontiers. On the southeast rise the Alps, the chief highlands of the country, which attain their greatest height on the border line. Here, rising to an altitude of 15,781 feet, is Mont Blanc, that snow-crowned peak which many have lost their lives in trying to scale. This, however, is but one summit in the towering ranges, and there are numerous others which are but little lower, if less picturesque and less famous. There are also several celebrated passes, Mont Cenis and Mont Genèvre, which lead from France into Italy, each being more than 6,800 feet above sea level.

On the south border are the Pyrenees, the natural boundary between France and Spain, which differ from the Alps in being a continuous range, the "gaps" or notches between the peaks being but little lower than the peaks themselves. Very high and very difficult are the few passes which lead across this wild mountain region, and no railway has yet attempted to cross them, but access to Spain is gained along the coastal strips at the ends. The culminating peak of the Pyrenees in France is Pic Long, 10,475 feet in height.



COMPARATIVE AREAS

Texas is so much larger than France that if the latter could be shaped differently and placed as an island in a sea as large as Texas it would not be visible from any point on the mainland.

Rivers. France has many rivers—about two hundred which are navigable, in part at least; but its four great streams are the Rhone, the Garonne, the Loire and the Seine. The Rhone, whose valley, as noted above, lies deep-carved between the plateau and the Alps, drains with its tributaries all the southeastern portion of the country, carrying to the sea a greater volume of water than any other French river. It rises in the Alps of Switzerland, and its two

chief branches, the Isère and the Durance, also have Alpine sources. The other three great rivers, to the west of the watershed, empty into the Atlantic. The Loire, the longest river of France and the one with the largest drainage basin, rises in the Cévennes, curves northward toward the sea through the plateau region, and ends in a wide estuary; the Garonne rises in Spain, finds its way along the edge of the great plateau, and after receiving a number of tributaries flows northwest and finally broadens into the estuary of the Gironde. These last two rivers are subject to disastrous floods and are in places obstructed by sandbanks. The Seine, which has the smallest basin of these four chief rivers, is the most valuable for navigation, forming with its tributaries and branching canals a great system of waterways over which a considerable part of the commerce passes. On this river Paris is situated.

France has few lakes, and these are of no great size. Lake Geneva, in the Alpine country, forms part of its boundary for thirty-two miles, but belongs to Switzerland. Near the coast in certain regions are numerous brackish lagoons or inland bays, but these have neither beauty nor any particular importance.

Climate Conditions. As a whole, France has a mild and even climate, due to its bordering seas, but there are very noticeable variations in the different parts of the country. The western coast regions are warm and damp, with a small annual range of temperature, but in the interior, and especially in the extreme east, the contrast between summer and winter is much more sharp. The central plateau has a rather bleak, unattractive climate, with high winds and cold winters, but just over the ridge, on the Mediterranean coast, is a delightful region with a subtropical climate—a region which with its olives and oranges seems more like Italy than like France. The average temperature for the year at Paris, in the north-central part, is 50°, that for July being 65° and that for January 36°.

The winds, which blow for the most part from the south and west, are warm and moisture-laden, and since no mountains near the coast force out the moisture, this is dropped fairly evenly over the country. Thirty inches is the average rainfall for all France, but a few regions in the mountains have forty, while a few districts in the northern plains have but ten.

Resources and Industries

As stated above, in the discussion of population, the statistics given of necessity have reference to conditions before the War of the Nations. How great will be the change and how long it will be before a normal state of affairs is reached cannot even be predicted now.

Agriculture. Primarily France is, and has been for centuries, an agricultural country, but until the nineteenth century there were vast areas of moor and heath and waste land. During that century, however, conditions changed, and at present less than one-twelfth of the land is waste. Most of the farms are small and are cultivated by their owners. The French farmers are by no means the stolid peasants of some of the other European countries, content with the antiquated methods practiced for centuries by their ancestors, but have always shown themselves progressive and ready to adopt the best scientific methods. As a result of this and of the favorable climate, French farms yield for the most part excellent returns. The plains of the north and northeast, with the valleys of the Rhone and Garonne, are the most productive regions. There is a national department of agriculture which not only provides courses in the public schools, but establishes special schools where the peasants may go for their training.

Crops. Among all the agricultural products of France there are two which stand out with special prominence—wheat and the vine. At least one-eighth of all the area of the country is annually under wheat, and no other European country except Russia raises as large a quantity of this important cereal. The peasants of France, unlike those of most European countries, do not live on the coarse "black bread," or rye bread, but have as their chief fare wheaten loaves. In all, France produces considerably more than one-third as much wheat as the United States. Oats is the cereal of second importance, and large crops of rye and barley are produced.

Vine-growing is perhaps the most characteristic industry of France. In Champagne, in Burgundy and near Bordeaux are raised the luscious grapes which yield the famous wines known by those names, and in other departments, particularly in the south, other varieties scarcely less satisfactory are grown. In good

years France is capable of producing almost half of the wine of the world, but French vine-growers have had a desperate struggle against the phylloxera, an insect whose ravages cause a formidable vine disease (see PHYLLOXERA). The only satisfactory method of combating this has been the grafting of French vines upon American stock. The cider output of France almost equals in quantity, though not in value, its wine production, and in Normandy and Brittany, in the north, apple trees are as characteristic a feature of the landscape as are the vines elsewhere. Other fruits are also grown in large quantities—plums, cherries and peaches in the northern districts and oranges and lemons on the sunny Mediterranean slopes; and nuts, especially chestnuts, which will grow where other trees will not, are of great importance. Chestnuts in France are not an occasional luxury, but are a staple food, the people of certain regions depending on them very largely. Another tree, to the cultivation of which much attention is paid, is the mulberry, which is grown not only for its fruit but for its leaves, on which the silkworms feed. Silkworm-growing, however, is decreasing.

Immense quantities of beets are grown, only three countries in the world surpassing France in the production of beet sugar; and tobacco, the cultivation of which is monopolized by the government, yields valuable returns.

Stock-raising. Grassland is comparatively scarce in France, and not enough stock is raised to satisfy the domestic needs. The animals most successfully grown are sheep, which yield an excellent quality of wool, and horses, in the improvement of which the government has helped largely, owing to the demand for good horses in the army. The peasants make much use of asses and mules.

Forests. France has not a very extensive wooded area, only about one-sixth of its surface being under forests. Many of these are forests in name only, being in fact but stretches of bush. Of the forest trees, with the exception of the chestnut which grows in beautiful luxuriance and renders picturesque many of the stream-sides, the most important are the beech, oak and elm, and in the mountain regions the pines and firs. It was the destruction of the forests in the mountains which made many of the rivers liable to floods, and the department of agriculture is doing its best to repair the damage by replanting, as well as to prevent the same mistake elsewhere.

The Mineral Yield. France is one of the fortunate countries which has a fairly large output of the two "staple" minerals, coal and iron. The coal beds are small—only about 2,100 square miles in extent, or one-twentieth the area of those of Illinois, but their production is extensive, over 40,000,000 tons being produced in a year. Most of this is bituminous coal, of good quality. It does not supply the needs of the country, and the imports of coal from the neighboring mines of Belgium and from England equal about half of the domestic yield. In the War of the Nations before the end of 1914 Germany had occupied the richest of France's coal and iron area.

In one of the western departments, Meurthe-et-Moselle, are some of the greatest iron mines in the world, and other regions yield lesser quantities. Only the United States, Germany and the United Kingdom produce more iron ore than France in normal times, or manufacture greater quantities of iron and steel. A large quantity of the ore smelted in the country, however, is imported.

Other metals—lead, zinc, copper, antimony and nickel—are mined in small quantities, but far more important than these are the marble and other building stones which are quarried in the Alps and the Pyrenees. Slate, also, of excellent quality, is obtained in large quantities. There are mines of rock salt, but the most of this mineral is evaporated from the lagoons and salt marshes along the coasts.

Manufactures. The location and extent of these have been largely determined by the position of the coal mines, or of the ports at which British coal is landed, for fuel transportation is not cheap in France. Of late years there has been a tendency in the manufacturing industries to seek the high mountain valleys, for there water power is available, and the electricity generated from it supplies all fuel deficiencies. French workmen have a peculiar skill rarely attained by the artisan-class in other countries, and various outputs of French factories are in great demand. Nowhere else are such exquisite laces and gauze, such tapestries and shawls and gloves produced; and certain regions make the most artistic glass and chinaware in the world.

Most important by all means are the textile manufactures, and among these the silk industry, which centers at Lyons, used to rank foremost. To-day, however, it is third, both woolen and cotton manufactures surpassing it, the former in the ratio of two and one-half

to one. Altogether, the textiles produced in a year are worth about $750,000,000. Next to the textile industries are those connected with metals. France manufactures comparatively little machinery, but its smaller metal products, whether of iron, steel, brass, silver or gold, have that special excellence of finish and that artistic touch so characteristically French. The making of wines and cider has been mentioned under the heading AGRICULTURE, and side by side with this has grown up the manufacture of beer.

Fisheries. These are extensive, employing about one hundred thousand men and having an annual value of over $30,000,000. Sardines, herring, mackerel and tunny are caught by tons, and on the west coast oyster-breeding is conducted on a large scale. The French fishermen do not content themselves with working the near-by waters. Their fishing fleets find their way to Iceland and even across the sea and carry back from the Newfoundland Banks millions of dollars worth of cod.

Transportation and Commerce. The United States, Germany, Russia and British India surpass France in length of railways, but no country surpasses it in speed and in excellence of service. The total mileage is about 30,400, and of this over one-fourth is owned by the state. All the other roads, at present owned by great companies, are under strict government control and will at the expiration of their franchises, about the middle of the twentieth century, became state property. Practically all of the great roads start from Paris and run toward the large towns.

France has a large and efficient system of canals, which with its rivers gives it about 7,100 miles of navigable waterway. The Atlantic is joined with the Mediterranean by means of a great canal, and most of the important rivers have canal connections with each other. There are also in the country great stretches of wonderful roads which have been in existence for centuries.

The total foreign trade of France amounts in a year to nearly $4,000,000,000, and of this imports make up somewhat more than half. These are chiefly grains, wood, raw cotton and silk, machinery, coal, wood, oil seeds and, strangely enough, wine; for France exports most of its own wine. The exports are cotton, woolen and silk goods, wine, clothes, Parisian articles and dairy products. In general it may be said that what is shipped from French ports is chiefly expensive manufactured products, while the incoming cargoes are of bulkier, cheaper raw materials. Great Britain, the United States, Belgium and Germany have had most of the French trade, but these conditions changed with the outbreak of the great war in 1914.

Social and Political Conditions

Education. No country of Europe has ever shown a keener interest in education than has France, especially in recent years, and the national system of education is an excellent one, capably administered. Formerly the schools were largely under the domination of the Roman Catholic Church, but in various ways that state of affairs has been done away with, chiefly through legislation. A large proportion of the girls who go beyond the elementary schools attend the convents, but boys are in far larger numbers sent to the secular schools, because government positions and certain professions are not open to those who have not attended state schools.

Education is free and compulsory between the ages of five and thirteen, and the system includes schools of all ranks, from the kindergarten, or "maternal school," which admits babies two years of age, to the highest university. Even in the primary and secondary schools boys and girls are taught separately, and the courses differ in many particulars, the girls' schools neglecting the ancient tongues and the more technical subjects and laying stress upon "cultural" studies. The secondary schools consist of the state colleges, or *lycées*, the communal colleges supported by the commune (see COMMUNE), and private schools, and even these latter are under the supervision of the minister of public instruction, for education is strongly centralized. For educational administrative purposes, the whole country is divided into seventeen districts, known as *académies*, and each of these has its own officers of instruction.

The state supports no fewer than fifteen universities, and there are special and professional schools of various kinds. One of the universities, that of Paris, has an enrollment of over 17,000 yearly.

Literature and Language. The literature and language of the nation are described under the titles, FRENCH LANGUAGE and FRENCH LIT-

ERATURE, in their alphabetical places in this volume.

Religion. By far the larger part of the inhabitants of France belong to the Roman Catholic Church—nearly 37,000,000, it is estimated; there are about 600,000 Protestants and 70,000 Jews. Previous to 1906 the state paid toward the support of all the Churches, the total amount expended annually being approximately $10,000,000; but in that year the relations between Church and State were severed, and each Church was thrown on its own resources. All beliefs are tolerated by the government.

Government. France is a republic, and is governed by a constitution which in the main dates from 1875. This constitution is not a single document, like that of the United States, but a series of laws and amendments, and it has not as its central motive the securing of the liberties of the people.

The executive head of the government, the President, is chosen not by popular vote, but by the two houses of Parliament. His term of office is seven years; he may be reëlected, but no President has served two full terms. He has a council of ministers, in theory appointed by himself, but in reality by the leader of the majority in the lower house, and these ministers are responsible to the National Assembly, and go out of office when their measures are defeated. Thus the system is much more like that of Great Britain than of the United States. The number of ministers, each of whom presides over a department, varies from time to time.

The National Assembly consists of two houses, the Senate and the Chamber of Deputies. The powers of these two bodies are approximately equal, except that only the lower house may originate revenue measures, in this respect following the example of the United States. The Senate comprises 300 members, chosen by electoral colleges composed of certain officials of the various departments, or states, into which the country is divided. The term of senators is nine years, and one-third of the terms expires every three years. Members of the Chamber of Deputies are chosen by universal suffrage, and hold office for four years. Their number varies, but in 1914 it was 597.

The judicial department consists of a series of courts, of which the highest is the Court [illegible]ation, at Paris, with its president, three [illegible]ts of sections, and forty-five judges. Below this are twenty-six courts of appeal, which try cases from the district or *arrondissements* courts, these in turn being engaged with cases from the lower canton courts. Police courts may try without jury any case which does not involve a heavier sentence than five years' imprisonment.

Local Government. For local administration purposes France is divided into eighty-seven departments, at the head of each of which is a *prefect,* appointed by the President of the republic and assisted by an elected general council. Below the departments are the arrondissements, 362 in number, each with a subprefect at its head; and below the arrondissements are the cantons. The smallest units for local government are the communes, of which there are about twelve to each canton. Each commune has an elected municipal council, and a mayor chosen by that body. A commune may be a part of a large town, a single smaller town, or several little villages. The most characteristic feature of local government in France is its direct dependence on the central or national government.

Colonies. The French colonies have an area vastly greater than that of the home country, and a population considerably larger. The following table gives statistics for them in the years before the war, some of the figures being but estimates, especially as regards population statistics:

COLONIAL POSSESSIONS	AREA	POPULATION
Algeria	343,500	5,563,828
Tunis	48,000	1,929,003
French Morocco	219,000	3,000,000
French West Africa	1,478,000	11,626,000
Sahara country	924,400	467,000
French Equatorial Africa	555,598	8,904,000
French Somaliland	5,790	208,100
Madagascar	228,790	3,198,889
Mayotte and Comoro Islands	837	94,663
Réunion	970	173,822
French India	197	282,379
French Indo-China	310,058	16,990,220
Saint-Pierre and Miquelon	93	4,652
Guadeloupe	687	212,430
Martinique	381	184,084
French Guiana	30,463	49,009
Pacific Islands	15,253	152,010
Total	4,162,017	53,040,089

The government of most of these colonies is not self-supporting, and the home government, which retains control of many matters in the colonies, must also contribute toward their revenue. Some, as Algeria, for instance, have changed in this respect and are now profitable possessions.

National Defense. See ARMY; NAVY.

History of France

Early France, or Gaul. The Romans had always felt a keen interest in the land beyond the Alps, which they called *Gaul,* and more than one general had attempted invasions, but not until the time of Caesar was the territory really conquered. He led his armies across the Alps in 58 B. C., and for eight years was engaged in struggle with the brave peoples he found there; and it was his *Gallic Wars* which gave to the Romans their first definite ideas of Gaul. "All Gaul is divided into three parts" was the introduction of the ancient Roman, as it is of the modern schoolboy, to the history of Gaul (see GAUL).

The Celts or, as the Romans called them, Gauls, proved apt pupils, and the four provinces into which the land was divided became thoroughly Romanized. Savage customs died out; Roman dress, Roman gods and Roman customs were adopted, and a form of the "rustic Latin" replaced the old Celtic dialects. Especially noteworthy was the growth of cities —cities of which the Roman Empire itself need not have been ashamed. Christianity was introduced, and it is not too much to say that by the fourth century A. D. all Gaul had adopted the new doctrines, in name at least.

Enter, the Franks. This peaceful development was not allowed to go on indefinitely. As the Empire became more and more feeble, fierce German tribes began to cross the Rhine and settle in various parts of Gaul. In the fifth century the Visigoths, the Burgundians and the Franks made homes for themselves, and gradually the last-named tribe began to stand out most prominently (see FRANKS). Their young king, Clovis, in the latter part of the fifth century, defeated the Roman governor, and some years later overthrew the Visigothic power, thus gaining control of almost all of Gaul. Through the entreaties of his wife Clotilda he became a Christian, and his warriors crowded about him and were baptized with him just as they would have crowded about him in battle and died with him. The Christian Gauls accepted him as they could never have accepted a heathen conqueror, and gradually the territory became a Frankish realm, or to put it differently, *France* came into being.

Clovis, founder of the Merovingian dynasty, as it is called from Meroveus, grandfather of Clovis, died in 511, and his possessions were divided among his four sons, according to the Germanic custom, instead of being given to the eldest, in the Roman way; and though they were reunited in 558 they were again divided three years later, and a period of civil wars ensued. The Austrasians, or Eastern Franks, and the Neustrians, or Western Franks, kept up a constant struggle for dominance, during which the kings became mere royal figure-heads—"do-nothing kings" they were called—and the mayors-of-the-palace, or prime ministers in the different divisions, became the real rulers.

A New, Strong Dynasty. Finally, in the late seventh century, Pippin of Heristal, Austrasian mayor-of-the-palace, succeeded in getting into his own hands control of practically all the Frankish realm, though he never took the name of king. Neither did his son, Charles Martel, the famous conqueror of the Saracens in the Battle of Tours in 732 (see FIFTEEN DECISIVE BATTLES; TOURS); but Pippin the Short, Charles's son, shut the weak Merovingian king up in his palace and had himself declared king in 751. He was a strong ruler and did much to consolidate the kingdom for his celebrated son, Charlemagne, who made himself master of a realm much wider than ancient Gaul or modern France (see CHARLEMAGNE). His ambition was the restoration of the old Empire of Rome, and he called his kingdom the New Empire of the West. In no sense, however, was this great realm France, for it was in effect a German empire; and so it continued through the periods of division that followed Charlemagne's death, though it was during this time that the division into the modern kingdoms of France, Italy and Germany began. Many of the rulers during this troubled period were feeble, and it was during the reign of such a one that the Norsemen, or Normans, landed in Northern France and had to be bought off from their depredations by the surrender of that province which has ever since borne their name.

The Real France. Meanwhile the great nobles had been increasing their power at the expense of that of the king, which grew more and more shadowy, and in 987 one of the dukes, Hugh Capet, was able to drive from the throne the king of that western region which had begun to be called France, and to make himself king instead. He founded what is known as the Capetian Dynasty, which in some of its branches reigned in direct male

succession down to the time of the Revolution; for France has never, as has England, had a sovereign queen.

By adding his own ducal possessions to those of the Crown, Hugh Capet increased somewhat the royal power, but the great nobles continued practically independent under him and his early successors. The later Capetian kings were stronger, and aided by the Crusades, during which many of the nobles died or were impoverished, succeeded gradually and quietly in drawing more and more territory and power into their own hands.

The Kings of France. In a brief article such as this it is impossible to give in detail the events of every reign. All of the important kings are treated in separate articles, however, and by reading those in connection with the general discussion here given a very clear idea of French history in its main phases may be obtained. The following list gives the rulers of France, including the Presidents.

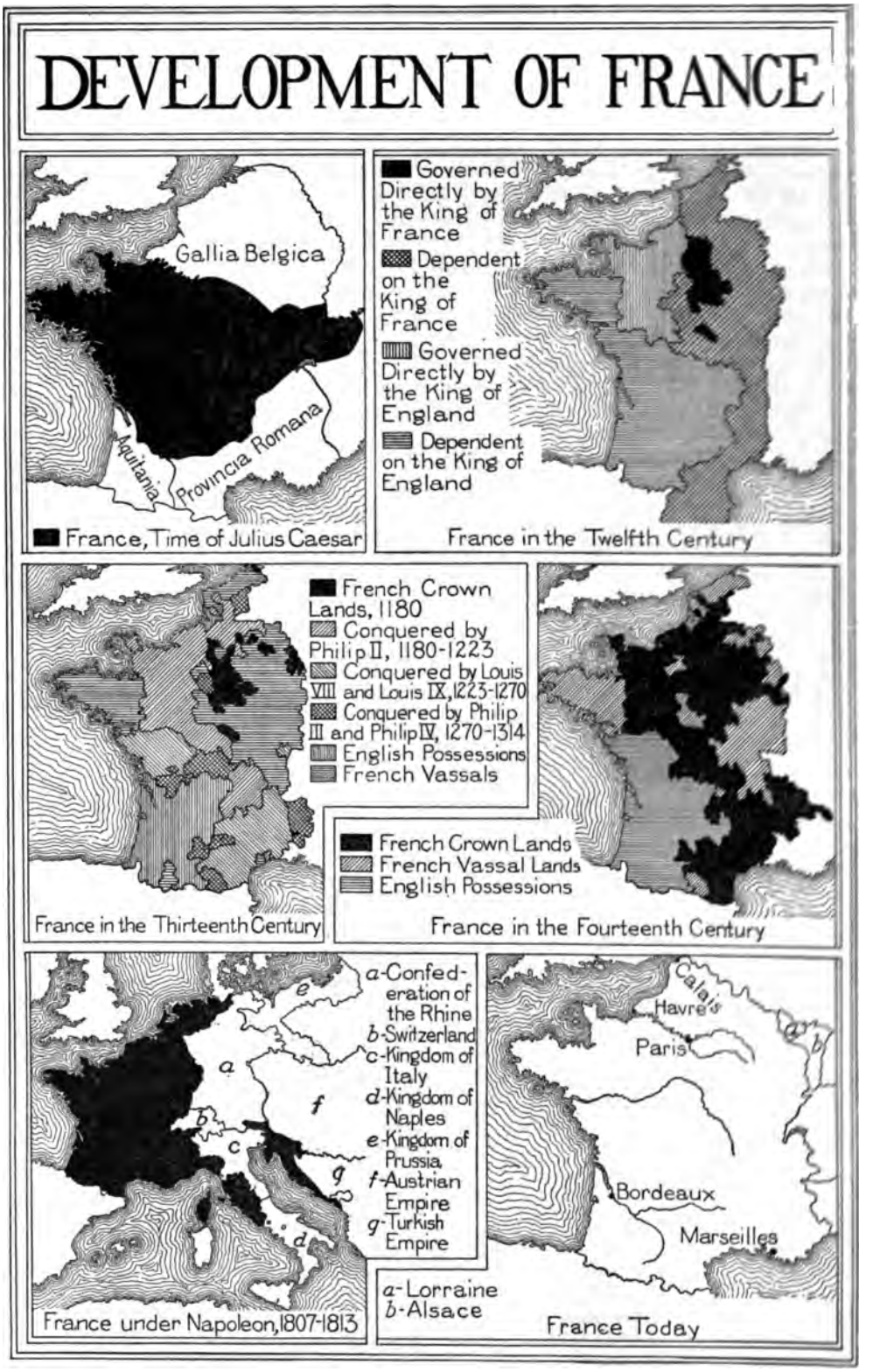
RULER	DATES OF REIGN
Hugh Capet	987- 996
Robert the Wise	996-1031
Henry I	1031-1060
Philip I	1060-1108
Louis VI, the Fat	1108-1137
Louis VII	1137-1180
Philip Augustus	1180-1223
Louis VIII	1223-1226
Louis IX (Saint Louis)	1226-1270
Philip III	1270-1285
Philip IV, the Fair	1285-1314
Louis X	1314-1316
John I	1316
Philip V, the Tall	1316-1322
Charles IV	1322-1328
Philip VI	1328-1350
John II, the Good	1350-1364
Charles V, the Wise	1364-1380
Charles VI	1380-1422
Charles VII	1422-1461
Louis XI	1461-1483
Charles VIII	1483-1498
Louis XII	1498-1515
Francis I	1515-1547
Henry II	1547-1559
Francis II	1559-1560
Charles IX	1560-1574
Henry III	1574-1589
Henry IV, the Great	1589-1610
Louis XIII	1610-1643
Louis XIV	1643-1715
Louis XV	1715-1774
Louis XVI	1774-1793
Republic	1793-1799
Consulate	1799-1804
Napoleon I, Emperor	1804-1814
Louis XVIII	1814-1824
Charles X	1824-1830
Louis Philippe	1830-1848
Republic, Louis Napoleon, President	1848-1852
Napoleon III, Emperor	1852-1871
Third Republic	
Thiers, Adolphe	1871-1873
MacMahon, Marshal	1873-1879
Grévy, Jules	1879-1887
Carnot, Sadi	1887-1894
Casimir-Périer	1894-1895
Faure, Félix	1895-1899
Loubet, Emile	1899-1906
Fallières, Clément Armand	1906-1913
Poincaré, Raymond	1913-

Growth of Royal Power. Of the later Capetian kings the strongest by all means were Philip Augustus, who nearly doubled the royal dominions; Louis IX, chiefly remembered for his part in the Crusades, but far more noteworthy because of his strong rule at home and his excellent personal qualities; and Philip IV. The direct line came to an end in 1328 with the death of Charles IV, and the branch line, the House of Valois (which see), succeeded to the throne in the person of Philip VI. The monarchy by this time was fairly well consolidated, and it had need to be, for there were troubled times ahead of it. Edward III of England resented Philip's succession, claiming the French throne for himself through his mother, and there began that series of conflicts known as the Hundred Years' War (which see). More than once it looked as though France might become a mere dependency of England, but through the heroic deeds of Joan of Arc (which see) the tide turned, and Charles VII found himself once more a king with a kingdom. All of France, which had been signed away to England by the insane Charles VI, was regained, with the exception of Calais, on the Strait of Dover, and France began to recover from the desolation the war had brought.

Much power had slipped back into the hands of the feudal nobles, but Louis XI, the first king after the close of the Hundred Years' War, was able to deal with such a state of affairs. His methods were ruthless, but his results were certain, and before the close of his reign he had laid the foundations for that absolute monarchy which was the outstanding characteristic of France in the centuries that followed. Charles the Bold, Duke of Burgundy, chief of the arrogant nobles, died in 1477, and his vast territories came to the Crown. Charles VIII, Louis's successor, married Anne of Brittany, and so gained that large province; then he attempted to extend his domains by an invasion of Italy. This was the first of those expeditions into Italy on the part of the French kings which had far-reaching results.

A Period of Wars. Under Francis I, one of the most elegant and accomplished princes of his time, France was very prominent in European affairs. The invasions of Italy were continued by him, at first with success, but when Emperor Charles V took the field against him Francis met defeat, and for a time was actually held a prisoner. To obtain his release he

DEVELOPMENT OF FRANCE



was forced to surrender all he had gained in Italy, and narrowly escaped giving up some of his French territories. The struggle against the Hapsburgs continued under Henry II, who also became involved in a war with England, which had allied itself with the German powers. During this conflict England was forced to surrender Calais, its last possession in France.

Another struggle began during the reign of Henry II—the struggle between the Catholics and the Protestants, or Huguenots, as they were called in France; and this developed in the succeeding reigns into a series of religious wars which almost rent the country asunder. The climax, but by no means the end, came in the massacre of Saint Bartholomew's Day, which failed in its purpose of utterly quelling the Protestants. Not until the accession in 1589 of Henry of Navarre, leader of the Protestants, as Henry IV, did the religious wars terminate, and even then they were brought to an end only by Henry's acceptance of Roman Catholicism. It was this king, the first of the Bourbons, who published the famous Edict of Nantes, giving full religious liberty to the Huguenots, and turning over to them several cities, including La Rochelle. By reason of his wise policies and the progress which the kingdom made under him he well merited the title of "the Great" and his assassination in 1610 was regarded as a national calamity.

The Age of Absolutism. Through the reigns that follow there is plainly visible the growth of that absolutism, that oppression which toward the end of the eighteenth century brought on its own punishment in the French Revolution. Richelieu stripped the nobles of all power, and as the general assembly had lost practically all of its constitutional rights and was little more than a court of law, the king, or his chosen minister with him, was an uncontrolled despot. Richelieu, Mazarin, Louis XIV—these are names which stand in the world's history for absolutism. Never in all its history was France more glorious outwardly than during the early years of Louis's reign. Successful in war, dominant at home, the king surrounded himself with all the elegance and glitter which a subservient people liked to see about their king; he has come down in history as the "Grand Monarch." But matters [illegible] armies failed, and the people, [illegible] unendurable burdens of tax- [illegible]enly to express their discontent. The reign of Louis XV was but a period of further depression and decay—costly wars, heavy taxes and a king and ministers for whom not the least respect could be felt. Louis XVI, who came to the throne in 1774, found matters in a desperate state. A stronger king might have mended affairs somewhat, but Louis's mild measures had no power to lessen the tyranny which the privileged classes exercised over the lower orders, or to cleanse a society rotten to the core. The financial condition of the country was hopeless, and the successive ministers attempted in vain to grapple with it.

Finally, in despair, one of them, Necker, counseled an extreme measure—no less than the calling together of the States-General, or parliament, which had not been summoned since 1614. In 1789 this body met, and with it began that violent movement, one of the most remarkable the world has ever witnessed, known as the French Revolution. The history of the next ten years is treated under that title (see FRENCH REVOLUTION), while that for the fifteen years following is included in the article on NAPOLEON I.

Reaction and New Discontent. It was said of the Bourbons that "they never forgot anything and never learned anything," and the truth of this was proved by Louis XVIII, who came to the throne on the downfall of Napoleon in 1814 (see BOURBONS), for he promptly turned from the moderate liberals, with whose support he had begun to govern, to the reactionaries, and tried to practice the same oppressive measures which had brought on the Revolution. His brother, Charles X, succeeded him in 1824, and proved even less liberal; and in 1830, when his ministry published ordinances curtailing the liberty of the press and lessening the elective privileges, an insurrection broke out by which Charles was overthrown and Louis Philippe was placed on the throne, as "king of the French." The *bourgeois*, or "middle class," king he was called, and for a time his rule was fairly popular, but he proved no more ready than his predecessors to grant liberties to the people, while in international affairs he took a decidedly subordinate place. In 1848, therefore, another revolutionary outbreak drove him into exile, and later in the year a republic was proclaimed. The first President elected was Louis Napoleon, nephew of the great Emperor—a man whose ambitions were by no means satisfied with being the head of a mere republic. He desired imperial

sway, and in 1852 he was able, by a sudden seizure of power, to have himself proclaimed emperor. Millions of votes confirmed his move, and the Second Empire was launched. For the events of the period see NAPOLEON III.

The growth of the Prussian power was watched by the French and especially by the emperor with increasing uneasiness, which reached its climax in 1870 when the vacant throne of Spain was offered to a Hohenzollern (German) prince. The demands which France made at this time so incensed Germany that war succeeded (see FRANCO-GERMAN WAR), the results of which might have been foreseen.

Germany had been preparing for just such a struggle for years, while the resources of France, on the other hand, were at a low ebb; and in a comparatively short time France suffered a complete and intensely humiliating defeat. Germany demanded so great an indemnity that it felt assured France would be crushed for a half century, but the Germans were paid within ten years. Alsace and Lorraine were also demanded by Germany, and the French never forgot this seizure (see ALSACE-LORRAINE).

Immediately on receipt of the news of the defeat of Sedan, Napoleon III was deposed and France was declared a republic.

The Third Republic. After a period of civil war and of humiliation, during which the German troops occupied Paris, a stable government was established, and Thiers was chosen President. He resigned in 1873 and Marshal MacMahon succeeded him, and two years later the present constitution of France was adopted. MacMahon resigned in 1879, and Jules Grévy was chosen his successor. Two years later France adopted its active colonial policy, first Tunis and then Madagascar being reduced to the rank of dependencies, or colonies, and this policy of expansion was pushed in the Far East, in Indo-China.

Reëlected in 1885, Grévy resigned in 1887, and Sadi Carnot became President. During his administration there took place a serious attempt of the radicals, the Orleanists and the Bonapartists, united under General Boulanger, to overthrow the republic. "Marianne," however, as the republic is called half in affection and half in good-natured contempt, was saved by Boulanger's loss of popularity. Carnot's administration also saw another sensation—the failure of the Panama Canal scheme, and the subsequent prosecution of a number of men high in public life (see PANAMA CANAL).

In 1894 Carnot was assassinated by an Italian anarchist, and Casimir-Périer was chosen to fill his place. He resigned in less than a year, and was succeeded by Félix Faure, during whose administration was begun the far-famed Dreyfus case (see DREYFUS, ALFRED), which threatened the very existence of the republic. This was continued under Emile Loubet, who was chosen President on the death of Faure in 1899. His administration was marked by the bill which separated Church and State (see subhead *Religion*, above), by the strengthening of cordial relations with Italy and Russia and by the establishment in 1904 of an English-French agreement which brought the two nations into closer touch than they had been in years.

Loubet was succeeded in 1906 by Fallières, and during his administration conflict with Germany seemed imminent because of opposing colonial interests, but Poincaré, the prime minister, was strong enough to avoid the crisis. Poincaré became President in 1913, and soon after he took office it became evident that relations between France and Germany were becoming more and more strained. A law was passed to increase the size of the French army, but before it could be made thoroughly effective the long-looked-for break had come—the War of the Nations had commenced, with an apparent cause quite apart from the interests of France.

The military movements, as well as the other significant features of that Titanic struggle are treated in the article WAR OF THE NATIONS; it remains here but to record a few points which relate especially to France. Most evident from the first was the loyalty of all classes to the government. Socialists, whose opposition to war had been feared; royalists, who had been looked upon as enemies of the republic, all responded eagerly to the call for troops. Even the priests, who had been rendered hostile by the withdrawal of state aid from the Church, showed a conspicuous loyalty, and thousands of priests joined the colors. It was tacitly assumed that Alsace and Lorraine were again to become French, in event of victory over the Teutonic powers, for France had never lost sight of that ambition since the Franco-German struggle almost half a century earlier; but only the outcome of the war can decide that important question with any certainty. J.A.A.J.

Consult Vizetelly's *Republican France: Her Presidents, Statesmen and Policy;* Poincaré's

OUTLINE AND QUESTIONS ON FRANCE

Outline

I. Location

(1) Latitude, 42° 20′ to 51° 5′ north
(2) Longitude, 4° 48′ west to 7° 31′ east
(3) Relation to other European countries
(4) Practical isolation

II. Size

(1) Actual, 207,128 square miles
(2) Comparative

III. Physical Characteristics

(1) Seacoast
  (a) Length
  (b) Character
  (c) Harbors
(2) Surface
  (a) Northern and western plain
    1. Average height
    2. Features of interest
  (b) South-central plateau
    1. Cevennes
  (c) The southern highland
    1. The scenic region
    2. Greatest altitude—Mont Blanc
  (d) The Pyrenees
(3) Rivers
  (a) Rhone
  (b) Garonne
  (c) Loire
  (d) Seine
  (e) Smaller rivers

IV. Climate

(1) General mildness
  (a) Effects of sea and mountains
  (b) Average temperatures
(2) Winds
(3) Rainfall

V. Industries

(1) The main industry—agriculture
  (a) Most productive regions
  (b) Productive methods
  (c) Chief crops
    1. Wheat
    2. Grapes
    3. Sugar beets
  (d) Stock-growing
(2) Mining
  (a) The "staple" minerals
    1. Coal and iron produced, but not in sufficient quantities
  (b) Minor importance of other minerals
(3) Manufacturing
  (a) Superior skill of French workmen
  (b) Chief products
  (c) [illegible]

VI. Transportation and Commerce

(1) Railroads
  (a) Mileage
  (b) Excellence of service
  (c) Government control
(2) Canals and rivers
(3) Roads
(4) Foreign commerce
  (a) Exports
  (b) Imports

VII. The People

(1) National characteristics
(2) Racial elements
(3) Population
(4) Density compared with that of other countries
(5) Slow growth of population

VIII. Education and Religion

(1) Excellent school system
(2) Higher education
(3) Predominance of Roman Catholicism
  (a) Disestablishment of state Church

IX. Government

(1) Republican in form
(2) The departments
(3) Local government
(4) Government of colonies and protectorates

X. History

(1) The "Gaul" of the Romans
(2) The coming of the Franks
(3) The strong Carolingian kings
  (a) Charlemagne
(4) The beginnings of the real France
  (a) The Capetians
(5) The Hundred Years' War
  (a) Joan of Arc
(6) The growth of the royal power
(7) The religious wars
  (a) Massacre of Saint Bartholomew's Day
(8) Growing absolutism
(9) The French Revolution
  (a) Causes
  (b) Events
  (c) Results
(10) The Napoleonic era
(11) The restoration and the July revolution of 1830
(12) The republic of 1848
(13) The second empire and the Franco-German War
(14) The third republic
(15) Recent growth
(16) The War of the Nations

Questions

What has been the cause of the very slow increase in the population of France?

How do the Pyrenees differ in general conformation from the Alps?

How many countries have a greater railway mileage than has France?

If a Frenchman commits a crime for which he may be sentenced to not more than five years' imprisonment, by what court is he tried?

How many sovereign queens has France had?

Who was the "Grand Monarch," and why was he so called? What effect did his reign have on the country?

How many countries of Europe have a greater population than France? How many are more densely populated?

What is the tallest peak in France? How does it compare with the tallest in Canada? In England? In the United States?

Is the popular song which refers to the beauties of "Apple-blossom time in Normandy" true to the facts in the case?

What may the Chamber of Deputies do which the Senate may not?

Why does the Battle of Tours rank among the fifteen decisive battles of the world?

What did France ever have to do with the Panama Canal?

What general difference is noticeable between the people of Northern France and those of the southern regions, and how is this accounted for by their origin?

If the ocean should rise 660 feet, what would constitute the seacoast of France?

Why do not the peasants of France eat as much rye bread as do those of some other countries?

What little insect has cost France millions of dollars?

How many Presidents have served two full terms? How does this compare with the number in the United States?

How did the Germanic method of inheritance differ from the Roman?

What was the last territory that England held in France? When was it lost?

How many republics have there been in France?

Characterize briefly the people of France.

Why do French farms produce more per acre than those of some other European countries?

Why are the high mountain valleys the best places for manufacturing concerns?

What effect did the policies of Louis XI have on the history of the country?

Why was the outcome of the Franco-German War a foregone conclusion?

How far could you travel in a straight line in France?

In olden times, what geographical advantage did France share with Italy and Greece?

How would a range of mountains near the west coast alter rainfall conditions?

Who was the great crusading king of France?

Of whom was it said that "they never forgot anything and never learned anything"?

Why is France almost as completely isolated as is Great Britain?

How do the imports of the country differ in general character from the exports?

What girl gave back to a king his kingdom?

What is the national flower of France?

How has the cutting down of forests injured the country?

Who was on the throne when the great Revolution broke out? In what measure was he to blame for it?

How France is Governed; Lilly's *The New France;* Lebon's *Modern France,* in "Story of the Nations" Series.

Related Subjects. The following articles in these volumes will give detailed information on many phases of the geography and life of France:

CITIES AND TOWNS

Agincourt
Aix
Alençon
Amiens
Bordeaux
Brest
Caen
Calais
Cherbourg
Cluny
Crécy
Dijon
Dunkirk
Fontainebleau
Grenoble
Havre
Le Mans
Lille
Limoges
Lyons
Marseilles
Montpellier
Nancy
Nantes
Nice
Nimes
Orleans
Paris
Poitiers
Rennes
Rheims
Roubaix
Rouen
Saint Denis
Saint Etienne
Saint Quentin
Sevres
Toulon
Toulouse
Tours
Versailles

COAST WATERS

Atlantic
Biscay
English Channel
Mediterranean

FORMER DIVISIONS

Brittany
Burgundy
Gascony
Normandy

HISTORY

Agincourt
Aix-la-Chapelle
Albigenses
Alsace-Lorraine
Bastille
Bonaparte
Bourbon
Capetian Dynasty
Carolingians
Chivalry
Commune of Paris
Continental System
Crécy
Crimea, subhead
Crimean War
Crusades
Directory
Emigrés
Feudal System
Field of the Cloth of Gold
Franco-German War
Franks
French and Indian Wars
French Revolution
Fronde
Gaul
Girondists
Guise
Huguenots
Hundred Years' War
Leipzig, Battles of
Liberty Cap
Louisburg, Sieges of
Merovingians
Mississippi Scheme
Nantes, Edict of
Normans
Orleans
Paris, Treaties of
Parlement
Powers, The Great
Quebec, Battle of
Reformation
Renaissance
Saint Bartholomew's Day, Massacre of
Salic Law
Sedan, Battle of
States-General
Succession Wars
Trafalgar
Triple Alliance
Triple Entente
Valois
Verdun, Treaty of
Vienna, Congress of
Waldenses
War of the Nations
Waterloo, Battle of
Westphalia, subhead
Peace of Westphalia
X Y Z Correspondence

Much of the history of the country is contained in the articles on the following persons of note. The kings are not indexed here because they are listed in the article above.

Barras, Count de
Bayard, Chevalier de
Carnot, Marie François Sadi
Charles Martel
Danton, Georges Jacques
Delcassé, Théophile
Dreyfus, Alfred
Eugene, François
Fallières, Clement Armand
Frontenac, Comte de
Gambetta, Leon
Genet, Edmon Charles Edouard
Godfrey de Bouillon
Grévy, Jules
Guizot, François P. G.
Joan of Arc
Joffre, Joseph Jacques Césaire
Lafayette, Marquis de
Lamartine, Alphonse de
Loubet, Emile
MacMahon, Maurice de
Marat, Jean Paul
Mazarin, Jules
Mirabeau, Count de
Montcalm de Saint-Veran, Marquis de
Murat, Joachim
Necker, Jacques
Ney, Michel
Poincaré, Raymond
Ribot, Alexandre Felix Joseph
Richelieu, Duke de
Robespierre, Maximilien
Rochambeau, Count de
Saint-Cyr, Laurent Gouvion
Saint Just, Antoine
Sieyès, Emmanuel Joseph
Talleyrand-Perigord, Duke de
Thiers, Louis Adolphe
Tocqueville, Alexis de
Waldeck-Rousseau, Pierre

LEADING PRODUCTS

Beet
Chestnut
Cider
Coal
Fish
Grape
Iron
Lace
Silk
Textiles
Wheat
Wine

MOUNTAINS

Alps
Cevennes
Jura
Mont Blanc
Pyrenees
Vosges

RIVERS

Aisne
Garonne
Loire
Marne
Meuse
Moselle
Rhone
Saône
Seine
Somme

UNCLASSIFIED

Champs Elysées
Corsica
Department
Gris-nez, Cape
Legion of Honor
Oriflamme
Tuileries

FRANCE, ANATOLE (1844-), the pen name of JACQUES ANATOLE THIBAULT, a French novelist and humorist, and since 1884 a member of the French Academy. Besides *The Crime of Sylvester Bonnard,* which established his fame, his works include *The Red Lily, Thais, The Garden of Epicurus* and his latest romance, *The Revolt of the Angels,* which deals with the adventures of Lucifer (which see) after his banishment from heaven. He is one of the most popular present-day writers.

FRANCHISE, *fran'chize,* a particular privilege of a public nature granted by the government of a state or city to individuals, associations or corporations, which does not belong to the citizens generally as a common right. A franchise may grant the right to a special use of public property, such as streets for electric cars, or the right to take needed private property, with compensation. All public service companies which are granted franchises must render service to all persons desiring it, on equal terms, without discrimination and for reasonable compensation. If this were not so, companies existing by the grant of public franchises, engaged in supplying the great conveniences of life, such as water, gas, electric lights, street cars, etc., could impose hardships upon the public. A franchise or corporation will not be allowed to allege as an excuse for failure to perform any duty required of it that it would be unprofitable. It cannot keep its franchise and refuse to perform its duties.

Each state or province decrees by statute the general terms upon which franchises may be granted, then local bodies, such as city boards of aldermen or county commissioners, issue the necessary permits. In years not long past it was customary to grant franchises for terms of fifty or seventy-five years, or even in perpetuity. People of to-day have learned that the best means of securing from public service corporations acceptable service is to grant privileges for no longer than twenty to thirty years. When a company must seek frequent renewal of its privileges it is quite likely to render the best possible service. Frequently in return for the privileges granted it, the company is made to pay to the municipality a portion of its net earnings.

FRAN'CIS, the name borne by two of the French kings near the beginning of the period of modern history.

Francis I (1494-1547) came to the throne in 1515 on the death of his father-in-law, Louis XII. During the greater part of his reign he was engaged in a bitter struggle with Emperor Charles V of Germany, whose election to the imperial dignity (see HOLY ROMAN EMPIRE) had been a source of great disappointment to the French king. Before beginning the war Francis invited Henry VIII of England to a conference, hoping to secure the latter as an ally, and the two kings, each attended by a magnificent train of nobles, met in 1520 on the famous Field of the Cloth of Gold (which see).

The conflict between Francis and Charles, which began in 1521 and ended with the Treaty of Crespy in 1544, resulted in no decisive advantage to either side. Its most striking features were the crushing defeat of Francis at Pavia, Italy, in 1525, where he was taken prisoner, the sack of Rome by an imperial army in 1527, and the French king's alliance with the sultan of Turkey. The most commendable feature of his reign was his patronage of art and learning.

Francis II (1544-1560), son of Henry II and Catharine de' Medici (which see), came to the throne in 1559. During his short reign of one year the government was in the hands of the uncles of his wife, who was Mary Queen of Scots. He was succeeded by his brother, Charles IX.

FRANCIS, the name of two sovereigns who have borne the title Holy Roman Emperor (see HOLY ROMAN EMPIRE).

Francis I (1708-1765) was crowned Holy Roman Emperor in 1745, nine years after his marriage to Maria Theresa of Austria, the only daughter and heiress of Emperor Charles VI (see MARIA THERESA). On the death of Charles, in 1740, Maria named her husband coregent with herself, but she kept in her own hands the actual management of the kingdom. To Maria also fell the burden of carrying on the Seven Years' War (which see), which broke out between Austria and Prussia in 1756. Joseph, son of Francis and Maria, succeeded his father as Holy Roman Emperor in 1765.

Francis II (1768-1835) was the last ruler to bear the title Holy Roman Emperor. He succeeded to the hereditary dominions of Austria in 1792, and later in the same year was elected Holy Roman Emperor. At this time Prussia and Austria were leagued together against the new republic of France, born of the French Revolution, and hostilities were continued until 1797, when, by the Treaty of Campo Formio, Francis was forced to cede Belgium and Lombardy to France. Two years later he entered into an alliance with Russia and England, hoping to check the ambitious designs of Napoleon, but the new war was most disastrous for Austria.

In 1804 Francis assumed the title "Emperor of Austria," and the following year made another alliance with Russia. The combined Russian and Austrian armies were hopelessly defeated by Napoleon at Austerlitz (1805), and the Holy Roman Empire, after an existence

of a thousand years, was dissolved. In 1806 Francis gave up his imperial title, being known thereafter as emperor of Austria.

He joined another league of the powers against Napoleon in 1814, and after the latter's downfall associated himself with Alexander I of Russia and Frederick William III of Prussia in the formation of the Holy Alliance (which see). During the remainder of his reign he ruled as an absolute monarch.

FRANCISCANS, *fran sis' kanz,* members of three great religious Orders, founded in the thirteenth century by Saint Francis of Assisi. The first Order is that of the *Friars Minor,* or gray friars; the second, that of the *Poor Clares,* or Franciscan nuns; and the third, the *Order of Penance* or *Tertiaries.* While their original aim was the spiritual welfare of the masses, the Franciscans soon became identified with great educational institutions. They are intimately associated with the mission work of the United States and Canada, where, notably along the Pacific coast, they labor nobly for the education and uplift of the Indians. See FRANCIS OF ASSISI.

FRANCIS JOSEPH I (1830-1916), emperor of Austria and king of Hungary, had one of the longest reigns in history. He became emperor in the revolution year of 1848, on the abdication of Ferdinand I, and succeeded to a troubled empire. Hungary openly revolted, even going so far as to declare a republic, but the young emperor succeeded in putting down the rebellion and establishing nearly absolute authority. The Hungarians did not placidly submit to having their liberties taken from them, and in 1853 a Hungarian almost succeeded in assassinating Francis Joseph.

FRANCIS JOSEPH

All the policies of the government were at first thoroughly reactionary, and the insurgents in Italy were put down as vigorously as those in Hungary had been. In 1859 a war broke out with Sardinia, and though France deserted Sardinia in the midst of the struggle, the result was the loss to Austria of Lombardy. The question of the supremacy of Austria or Prussia led to the Seven Weeks' War, which ended disastrously for Austria, and after the close of that struggle Francis Joseph adopted more liberal policies. Constitutional rights were granted, and the Austro-Hungarian state as it exists to-day was formed, the emperor being crowned king of Hungary in 1867.

Francis Joseph always enjoyed a very considerable popularity, and this, rather than any real spirit of union, held his dual realm together. During his reign industrial conditions greatly improved, and the country made far more progress than ever before. The life of the emperor was saddened repeatedly by tragedies which stirred the nation and the world. In 1898 his empress, Elizabeth, whom he had married in 1854, was assassinated by an Italian anarchist; in 1899 his only son was killed, which left a nephew, Archduke Francis Ferdinand, as heir to the throne. In June, 1914, Francis Ferdinand and his consort were murdered in their carriage, in Serajevo, Bosnia, by a Serbian, a tragic incident which hastened the War of the Nations two months later. These events accentuated the troubled political condition in the realm of Francis Joseph and denominated him the "monarch of many sorrows." He was succeeded November 21, 1916, by his nephew, who assumed the title Charles I. See AUSTRIA-HUNGARY, subhead *History.*

FRANCIS OF ASSISI, *ah se' zc* (1182-1226), an Italian monk and founder of the religious Order of the Franciscans. In youth his ardent piety prompted him to dispose of his worldly belongings and to devote himself to the service of the poor and afflicted. As his followers increased he journeyed to Rome to obtain the Papal permission to found a religious Order. This was granted after some opposition, and the friars began to increase in number and to spread everywhere. The rule of the Order was based upon the strictest poverty, which implied no property, and existence by means of alms. The simple, austere life of Saint Francis, particularly his deep love for all created things, inspired many non-Catholic movements to honor his memory. One of these was organized by Paul Sabatier, a French Calvinist minister, its object being to study the life and virtues of the saint. See FRANCISCANS.

FRANCKE, *frahnk' e,* AUGUST HERMANN (1663-1727), a German educator, founder of the Francke Institutes at Halle, whose methods and theories have permanently influenced the Prussian system of public education. He was born in Lübeck and educated at the uni-

versities of Erfurt, Kiel and Leipzig. In 1691 he was appointed professor of Greek and Oriental languages at the University of Halle, and at the same time began his duties as pastor of a suburban church. Four years later he established a free school for the children of his parish, the beginning of an educational work of far-reaching importance. From this small beginning developed an elementary school for the children of the citizens of Halle, an orphan asylum, a boarding school for well-to-do boys, a training school for teachers and a Latin school. Many notable educational leaders went out from his institutions, and his methods were followed in various parts of Europe. At the present time the Francke Institutes form in themselves almost a suburb of the city of Halle, and are given government support.

FRANCO-GERMAN WAR, a momentous struggle which took place between Germany and France in 1870-1871. By its overthrow of Austria in the Seven Weeks' War Prussia had placed itself at the head of the German states, and this position it was determined to maintain. Napoleon III of France recognized the fact that nothing would so strengthen his government as a successful foreign policy, and particularly a defeat of Prussia, the ancient enemy of France. Meanwhile Bismarck, the great German statesman, was equally anxious for a struggle. A cause was not far to seek, and was found in a question as to the succession to the Spanish crown, which had been offered by Marshal Prim to Prince Leopold of Hohenzollern, a German. It was felt in France that this would increase the power of Prussia beyond safe limits, and although Leopold voluntarily withdrew his name, the French government demanded of Prussia a promise that no Prussian prince should ever sit upon the Spanish throne. Naturally Prussia refused to comply with this demand, and the result was a declaration of war on the part of France.

Both countries went into the struggle with great enthusiasm. In Prussia, where the probability of such a war had long been foreseen, the army was in a state of readiness, and plans had been carefully made by the military genius, Von Moltke. In France, on the contrary, no one seemed to have a correct measure of the forces that might be drawn upon, and they proved vastly inferior in numbers and in organization to what had been hoped. Only about 250,000 men were found to be available, as against 450,000 Germans, who had also a reserve of almost 400,000. The victory was with the Germans from the first. At Weissenburg, at Wörth and at Spichern the French armies were defeated, and their numbers were greatly lessened. At length the forces divided into two parts—one under MacMahon and one under Bazaine; and these two were separated by the Germans and prevented from effecting a junction. Bazaine was defeated and surrounded at Metz, and thus kept from giving any aid to France. MacMahon, ordered to march to the relief of Bazaine, met the Germans near Sedan, and there was fought a great battle which resulted in the total defeat of the French and the surrender of the whole army, with Napoleon (September, 1870). In October of the same year Bazaine was forced to surrender at Metz.

When the news of the defeat at Sedan reached Paris, Napoleon was deposed and France was declared a republic. The first task of the new government was to put Paris in condition to withstand a siege. Despite the heroism of the inhabitants, however, and the utmost efforts of the French army, the siege was continued only until February, 1871, when the city was forced to yield. A treaty was drawn up, in accordance with which France gave up Alsace and the German-speaking part of Lorraine and pledged itself to pay a war indemnity amounting to about one billion dollars. This war, which proved the total overthrow of the second empire in France, greatly strengthened the plans for German unity by bringing the various German states together against one enemy. See subtitle *History,* under FRANCE and GERMANY. A.MC C.

Consult Maurice's *Franco-German War,* in "Cambridge Modern History" Series; Hertslet's *The Map of Europe by Treaty.*

FRANCOLIN, *frang'ko lin,* a game bird related to the partridge. There are forty or more species, most of which are found in Africa. The coloration of all is rich and varied, and the plumage of the sexes is practically alike; in this francolins differ from most other birds. They travel in family parties, rather than in coveys, and fly swiftly and heavily. They feed in the morning and at evening, at which times their

THE FRANCOLIN

loud, shrill cries may be heard in all directions. Their diet consists of insects, berries, seeds and bulbs. Their nests are well concealed and resemble those of the partridges. Six to fourteen eggs are laid in the autumn and spring; these are brown and buff in color, with small, dark spots. Francolins once abounded in Southern Europe, but are now extinct there.

FRANKFORT, IND., the county seat of Clinton County, is situated north and west of the center of the state, twenty-four miles southeast of Lafayette and forty-seven miles northwest of Indianapolis. It is on Prairie Creek and on the Vandalia; the Lake Erie & Western; the Toledo, Saint Louis & Western (Clover Leaf), and the Chicago, Indianapolis & Louisville railroads. It has two interurban lines, one extending to Lafayette, the other to Indianapolis. The area of the city is about three square miles. The population in 1910 was 8,634; in 1916 it was 9,596, by Federal estimate.

Among the more prominent structures are a $200,000 courthouse; a Federal building, erected in 1914 at a cost of $80,000; the home office of the People's Life Insurance Company; an opera house, Masonic Temple, Elks Home and a Carnegie Library. The public park of eighty-three acres contains a golf course, baseball grounds, tennis court, zoo, swimming pool and playground equipment.

The city contains a number of large grain elevators, and is an important grain market. The wholesale business amounts to nearly $1,500,000 annually. Among a number of wholesale houses are those handling meat, fruit and vegetables, poultry, confectionery and barber supplies. Broom and handle factories, planing and saw mills, two electrically-equipped flour mills, a large creamery plant with an annual output of 2,700,000 pounds of butter, a kitchen cabinet factory, stove and furnace and canning factories and an artificial ice and refrigeration plant are the important commercial enterprises. The Clover Leaf railroad shops are located here. Frankfort was founded in 1830 and chartered as a city in 1875. F.R.

FRANK'FORT, KY., the state capital and the county seat of Franklin County, is twenty-nine miles northwest of Lexington, fifty-five [illegible] of Louisville and ninety-three miles [illegible] ncinnati. It is on the Kentucky [illegible] on the Louisville & Nashville, the [illegible] & Ohio and the Frankfort & Cin- is also served by an interurban line, and there is steamboat communication with Cincinnati, Louisville and other river ports. The area of the city is nearly ten square miles. The population was 10,465 in 1910, and 11,080 in 1916, by a Federal estimate.

Special Features. Frankfort is built upon low rolling hills on both sides of the river, which is crossed by a suspension bridge 700 feet long. The surrounding country is the famous Blue Grass region of Kentucky. The city contains a number of beautiful buildings, the most prominent of which is the new Capitol, erected at a cost of $2,000,000. It is constructed of granite and white limestone, in the Italian Renaissance style. In it are housed the state library and the library of the Kentucky State Historical Society, in whose rooms are some valuable works of art. The old Capitol, first occupied in 1829, is still standing, and is a noteworthy specimen of early American architecture. Other prominent structures are the Federal building, erected in 1883 at a cost of $180,000, and recently enlarged at a cost of $125,000; the governor's mansion, state arsenal, Y. M. C. A. and public library. Here also are located a state normal for colored people, the state home for feeble-minded children and the state penitentiary. Glenwood Park and the grounds surrounding the new Capitol together contain about sixty acres.

Franklin (state) Cemetery, beautifully situated on a hill near the city, is an interesting historical burying ground. In it lie the remains of Daniel Boone and his wife, Vice-President Richard M. Johnson, the sculptor Joel T. Hart, the poet Theodore O'Hara, who wrote *The Bivouac of the Dead,* twelve governors of Kentucky, nine United States Senators, four ministers to foreign countries and three United States district judges.

Industries. The varied industries of Frankfort include manufactures of lumber, flour, shoes, chairs, tobacco, twine, whisky, brooms and other commodities. There are canning factories and two reel factories. Water power is furnished by a lock and dam across the river. Hemp and tobacco are extensively raised about Frankfort, and the city has a large wholesale trade in these and other products.

History. Frankfort was founded in 1786 by General James Wilkinson, who made the settlement the base of his trading operations and intrigues with the Spanish at New Orleans. It became the state capital in 1792. J.O.L.

FRANKFORT-ON-THE-MAIN, a German commercial city, the birthplace of Goethe, the nation's most distinguished poet; Feuerbach, the philosopher; Schlosser, the historian; Kirchner, the scholar and naturalist, and many other celebrated men. The city is situated in the Prussian province of Hesse-Nassau, on the right bank of the River Main. Frankfort was long the place of election of the German emperors. In the election room of the Rathaus, or Römer, a Gothic structure dating back to the fifteenth century, electors have had many historical meetings, while in its Kaisersaal, or imperial hall, many newly-elected emperors have held public banquets. From the thirteenth to the sixteenth century, the coronation took place in the Cathedral of Saint Bartholomew, one of the city's most remarkable churches.

In recent years Frankfort has been greatly extended and improved, and many fine public and private buildings have been erected; among them are the new opera house, one of the finest in the world; the courts of justice, and the new exchange. The city lies at the junction of seven railways, and it has direct ocean communication by way of the Main and the Rhine. It is one of the most famous banking centers of Europe. Although insignificant compared with its commercial activities, the city's leading manufactures include colonial wares, machinery, soap, perfumery and hats.

Frankfort is rich in associations of literature and art, as well as in establishments to promote them. Notable among the latter are the Historical Museum, the Städel Art Institute and the Rothschild Library. In the public squares are fine statues of Goethe, Schiller and Gutenberg. The city dates from the time of Charlemagne. After Napoleon's downfall it became a free city—one of the four in Germany. However, in 1866, having espoused the unsuccessful Austrian cause in the Seven Weeks' War, it was seized by the Prussians and later formally incorporated with Prussia. Population in 1910, 414,576.

FRANKFORT-ON-THE-ODER, an important commercial town, carrying on an extensive trade both by land and water, is a town of Prussia, in the province of Brandenburg, fifty-one miles southeast of Berlin. Three great fairs are held here annually. The town, which is well built, has many iron foundries, tanneries, and breweries; its chief manufactures consist of machinery and metal goods, chemicals, organs, leather, stoneware, tobacco, spirits and paper. The university, founded in 1506, was incorporated with that of Breslau in 1811. Among its chief buildings are the Church of Saint Mary, the Rathaus and a theater. The Oder is a navigable river, and, because of its connection by canals with the Vistula and the Elbe, Frankfort-on-the-Oder has always enjoyed considerable commercial importance. Population in 1910, 68,230.

FRANK'ING PRIV'ILEGE, the right to send letters and packages through the mail without charge. In Great Britain the privilege was abolished by Parliament in 1840, excepting for official documents. The same rule applies to Canada.

In the United States it was first accorded to soldiers in actual service during the Revolutionary War; then to officers of the government, Senators and Representatives in Congress, postmasters for official correspondence, newspaper exchanges and petitions to Congress, and later, exchanges of the Smithsonian Institute and medals and testimonials to soldiers. The first four Presidents were accorded the franking privilege for life, and it was granted to the widows of ex-Presidents Garfield, Cleveland and Harrison by Congressional vote.

The privilege was entirely abolished in 1873 in the United States, but was partially restored later. The President, Vice-President, Senators, Representatives and Delegates in Congress, Secretary of the Senate and Clerk of the House of Representatives may send and receive free through the mail all public documents printed by order of Congress. Official business of each executive department or bureau of the government is always franked. Seeds may be transmitted by the Department of Agriculture; any member of Congress receiving seeds from the Department for distribution may mail them free. All official correspondence of the Superintendent of Documents is entitled to free transportation, and he is entitled to frank public documents. Envelopes for franking mail are marked *Official Business.*

The franking privilege has been greatly abused at times. In theory it is excellent, for public documents of an instructive nature should reach interested persons without expense. However, there have been instances of mailing half a million copies of Congressmen's speeches simply as arguments in the heat of a political campaign, against which practice much objection is made. The fine for franking private mail matter is $300.

FRANKLAND, or **FRANKLIN,** a name given in 1784 to a short-lived state organization, of which John Sevier, a notable man at the time, was governor. It was formed as a protest against the action of North Carolina in depriving its citizens of state government. At the close of the Revolutionary War Congress had no money to pay its debts, and asked all the states holding Western lands to donate them to the Federal government. North Carolina, of which the present Tennessee was then a part, agreed, but the settlers of this latter region did not give the plan their approval, and they set up a new state which they named Frankland, or Franklin. They fixed the salaries of their officers at so many raccoon skins, because of the scarcity of money. After a hard struggle, North Carolina suppressed the new government in 1788. The territory of Tennessee was ceded to the United States government in 1790, and in 1796 it was admitted as the sixteenth state of the Union. See TENNESSEE, subhead *History*.

FRANK'LIN, a district of the Northwest Territories of Canada, named in honor of Sir John Franklin. It was formed in 1895, and includes many islands to the north of the mainland, as well as Baffin Land and Albert Land. It is practically uninhabited, for it is almost entirely within the Arctic Circle; the only inhabitants are a few Eskimos in Baffin Land. The total area is estimated at 500,000 square miles. In some parts of the district musk-oxen, bears, foxes and other fur-bearing animals are found in large numbers. For further details, see NORTHWEST TERRITORIES.

FRANKLIN, BENJAMIN (1706-1790), one of the first great Americans and, what can be said of few men in all the world's history, a man distinguished in almost every field of endeavor. The epigrammatic inscription carved on a medallion of him, "He has seized the lightning from Heaven and the sceptre from tyrants," mentions but two of the numerous phases of his activity. Scientist, author, statesman, philosopher, inventor, printer, diplomat, humorist—surely few other men ever ventured on so many careers and worked them out so successfully. "America's patron saint of common sense," he is called, and the description fits him well; for in everything he did, in everything he said and in everything he wrote there was evidence of plain, unsentimental, common sense.

Early Life. Benjamin Franklin was born on [illegible] 17 1706, in Boston, where his father was a tallow chandler. As the family was poor and as Benjamin was the fifteenth of seventeen children, he had no special advantages and went to school less than a year. He disliked the work in his father's shop and was therefore apprenticed to an older son, who was a printer, though it had been the family's intention to devote this tenth son as its "tithe for the ministry." In his brother's office Franklin mastered his new trade, and found

BENJAMIN FRANKLIN
He was the characteristic figure of the age in which he lived; yet we to-day find him as modern as ourselves.

time to read much, and thoughtfully. Books were not numerous, but *Pilgrim's Progress*, Plutarch's *Lives* and an old volume of the *Spectator* with Addison's matchless essays never lost their charm for him.

That he was forming an English style as well as entertaining himself was soon evident from the little essays which began to appear in his brother's paper, the *New England Courant*. These Franklin had slipped under the office door, and the brother was well pleased to print them, but when he learned who their author was he refused to publish more and soundly scolded the daring youth. Indeed, friction between the two brothers was constant, and finally, in 1723, the younger ran away to Philadelphia. Most people, even those who have not read the rest of Franklin's autobiography, are familiar with his account of his first day in Philadelphia. Having spent his last money for three "great puffy rolls," he walked down the street eating one and carry-

ing the others under his arm, while a young girl, whom fortune destined to be his future wife, stood in a doorway and laughed at him.

Beginnings of Success. Franklin's knowledge of printing soon secured him work, and so able did he prove to be that in the next year Sir William Keith, the governor of the colony, sent him to England to buy a printing outfit. Keith did not live up to his promises, however, and Franklin worked for a year and a half in London, acquiring new skill. Shortly after his return to Philadelphia he found a partner who had money, so he opened a printing shop for himself, and in 1729 bought the *Pennsylvania Gazette*, which he edited and printed so ably that he became known through all the colonies. His public life had now begun, and his influence became stronger and stronger, especially on the questions of frugality, industry and temperance. *Poor Richard's Almanac*, which appeared yearly from 1732 to 1757, carried into thousands of homes his practical wisdom and made his quaint, pithy sayings part of the national speech. On every tongue were to be heard such of his proverbs as "God helps them that help themselves"; "Never leave that till to-morrow which you can do to-day"; "Silks and satins put out the kitchen fire"; "Lying rides upon debt's back"; "'Tis hard for an empty bag to stand upright." It is difficult to estimate the actual effect which they had in promoting thrift.

WHEN HE ENTERED PHILADELPHIA
A statue of Franklin, at the age of seventeen, modeled by McKenzie.

Public Services. But Franklin's part in American life did not consist merely in preaching; he performed momentous services, as well. In Philadelphia he founded the first American public library and a magazine, initiated the postal service, fire companies and a police system, and introduced so many improvements that the city stood as the metropolis of the colonies. Politically, too, he was active. Beginning in 1736 as clerk of the Pennsylvania Assembly, he rose steadily, serving as postmaster of Philadelphia, as a member of the Assembly, and in 1753 as postmaster-general of the colonies. In 1754, in the Albany Convention, he brought forward a plan for colonial union, but neither the colonies nor the mother country favored it, and it was rejected. He did not fight during the French and Indian War, but he did something just as important —guaranteed transportation and supplies to Braddock's forces, and paid for such out of his own funds, which by this time amounted to a considerable fortune.

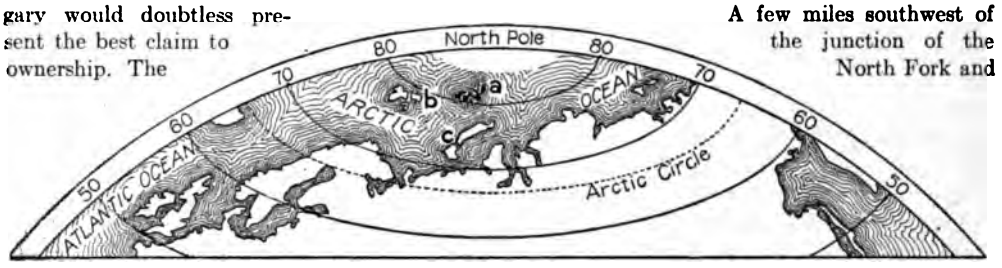
From 1757 to 1775 he spent most of his time in England, attempting to avert the struggle between that country and the colonies. He detested war; "There never was a good war or a bad peace," he wrote, but when it really came he returned to his home and stood shoulder to shoulder with the other patriots. He was one of the framers and signers of the Declaration of Independence, and it was on the occasion of the signing that he remarked with his quiet humor, "We must all hang together, or assuredly we shall all hang separately." During the war he was sent to France; there his extreme popularity did much to win for the colonies immediate concessions and later a definite treaty of alliance with France. Nothing shows more clearly the esteem in which he was held than the fact that he was the only American to sign the Declaration of Independence, the treaty with France, the Treaty of Paris with which the war closed, and the Constitution of the United States.

Service to Science. It might seem that these activities were enough to demand all of a man's energy and time, but there was another side to Franklin's genius. In 1746 he saw performed in Boston some electrical experiments which interested him greatly, and six years later he proved by an experiment with a kite in a thunderstorm that lightning and electric-

HIS BIRTHPLACE
In Milk Street, Boston.

Frankfort-on-the-Main was founded by them in the fifth century; it became the capital of the Eastern Franks in 843, and Charlemagne built his palace there.

FRANZ JO'SEF LAND, a group of about 100 small, uninhabited islands in the Arctic regions, north of Nova Zembla. They are not politically attached to any country, but the flags of different nations have at different times been raised there by exploring parties. They were discovered in 1873 by an Austro-Hungarian expedition and named after the emperor of Austria; were they of value Austria-Hungary would doubtless present the best claim to ownership. The islands are much broken up by bays, straits and fiords, and more than nine-tenths of the land is perpetually covered with ice. Here and there appear bare patches on which moss, lichens and a few Arctic flowers grow.



FRANZ JOSEF LAND

In the map (*a*) is Franz Josef Land. To aid in locating these islands: (*b*) is Spitzbergen, to the west, and (*c*) is Nova Zembla, to the south.

The islands are of volcanic origin, formed principally of basalt. Fossils of animals and plants have been found in the lower strata, many of these remains tending to prove that this desolate region was once the home of animals and plants now found only in warm climates (see GEOLOGY). Although high in Arctic regions, the temperature is not as low as might be expected; the average for the coldest month is 19° below zero and the thermometer frequently rises to 35°.

FRASER, *fra'zer,* **RIVER,** a river of Western Canada, noted for its salmon fisheries and for the magnificent scenery and the rich gold fields through which it flows. Its course lies wholly within the province of British Columbia, and its drainage basin, which has an area of 142,000 square miles, includes most of the southern half of the province, with the exception of the southeast corner and a strip along the Pacific coast.

The Fraser is formed by the junction of two forks at a point a short distance northeast of Fort George, in the central part of the province. The North Fork, short and not important, rises in the Rocky Mountains near Smoky River Pass and flows almost straight west. The South Fork, which is the main river, rises in the Rocky Mountains near Yellow Head Pass and flows northwest for 160 miles to meet the North Fork. The united river makes a sharp curve around the northern end of the Cariboo Mountains, and then flows southward almost to the international boundary. Then it turns sharply to the west and empties into the Gulf of Georgia between Vancouver Island and the mainland. The total length of its course is 695 miles.

A few miles southwest of the junction of the North Fork and the South Fork, the Fraser receives from the west the Stuart River, carrying the surplus waters of Fraser Lake and Stuart Lake. Its other important tributaries, in order, are the Blackwater from the west; the Quesnel from the east; the Chilcotin from the west, and, most important of all, the Thompson, one of whose branches rises in the Rocky Mountains less than fifty miles from the source of the North Fork of the Fraser itself. Southward from Lytton, where it receives the Thompson, the Fraser River flows in majestic canyons which it has cut through the Coast Range.

The Fraser is a typical mountain stream, swift throughout its length and in many parts not navigable even for canoes. It is navigable for small steamboats from its mouth to Yale, a distance of eighty miles, and from the mouth to New Westminster, fifteen miles, it is navigable for ships drawing twenty feet of water. The Fraser might be called the economic heart of British Columbia, for it contributes to the three chief industries, mining, lumbering, and fishing. The placer and vein gold along its banks and the banks of the Thompson first drew the world's attention to the region and stimulated its growth. The river valley, particularly in the lower course, is densely wooded, and the rapid current supplies facilities for the transportation of lum-

ber. Lastly, the Fraser River salmon are justly famous, and the fisheries are the most important in Canada. For additional information relating to these industries, see BRITISH COLUMBIA.

FRASERVILLE, *fra'zer vil,* the county town of Temiscouata County, Quebec, situated in the southeastern part of the province and on the right bank of the Saint Lawrence River, at the point where it receives the waters of the Rivière du Loup. Rimouski is sixty-six miles northeast, and Quebec is 115 miles southwest. Railway transportation is provided by the Intercolonial and Temiscouata railways; the latter makes Fraserville its terminus. There is regular steamer service by the Saguenay Line, and local lines ply between Fraserville and Tadoussac, a seaside resort. The place was settled in 1874, and was incorporated as a city in 1910. Fraserville is the corporate name for the town of Rivière du Loup. French Canadians comprise the greater part of the population, which in 1911 was 6,774; in 1916, estimated, 7,000.

The city lies in the midst of some of the most picturesque scenery of the province, in a locality that offers fine fishing and hunting (moose and deer); consequently it has won favor as a summer resort. There are several hotels, also an armory, a $50,000 post office and large wholesale houses. Besides the public schools, there are three colleges and a convent. The largest industrial establishments are the repair shops of the railroad; these employ about 400 men. Pulp mills, gristmills, brickyards, foundries and factories for making butter, furniture and building materials are among the other manufactories. Abundant water and electric power is provided for manufacturing purposes. E.T.

FRATERNAL SOCIETIES, voluntary associations formed for the purpose of mutual advantage, and conducted solely for the benefit of members and beneficiaries. These societies are organized on the lodge system, with rituals and pass words, and each member pays, by means of assessment, a certain amount to the common fund. Each society has general power to adopt its own constitution and by-laws, within limitations, and may manage its own internal affairs as it deems to its best interests. Men alone are eligible to membership [illegible] these societies; others admit both [illegible]en, and a few are for women [illegible]er of them have memberships [illegible]he millions.

History. The early fraternal societies were founded somewhat along the same lines as the English "friendly societies," which were first organized as clubs for the sick and paid small sums for the benefit of their members. This idea finally developed into payment also for disability, funerals, accident, disease and old age benefits. Several of these societies founded branches in the United States and Canada in the early part of the nineteenth century. In 1868 the Ancient Order of United Workmen was founded by John Upchwich, it being the first order in the United States to develop coöperative relief on a large scale, in the form of life insurance or death benefits. During the next ten years many other fraternal societies were organized, and from 1881 to 1890 many additional ones were introduced; but the greater proportion of these were short-lived, owing to unsound financial methods. Since 1900 there have been few new societies organized.

Governing Methods. All the older associations elect representatives from the subordinate lodges within what is known as the grand jurisdiction limit. The latter, in turn, sends delegates to the supreme body, which is the highest authority. The grand jurisdiction usually covers a state, and has supervision of all the lodges in its territory. The supreme body generally elects its officers, but they may in some cases be elected by a direct vote of all the members.

In 1898 The American Fraternal Congress was formed for the purpose of establishing reserve funds, and in 1901 the younger fraternal societies formed the Associated Fraternities of America. In 1903 these general societies united under the name of the National Fraternal Congress of America.

Membership. The principal organizations in the United States and Canada having more than 200,000 members in 1917 are listed below:

Freemasons	1,760,277
Odd Fellows	1,622,100
Modern Woodmen of America	921,899
Eastern Star, Order of	800,000
Woodmen of the World	732,365
Knights of Pythias	729,053
Rechabites, Independent Order of	701,040
Good Templars, International Order	620,000
Loyal Order of Moose	620,000
Improved Order of Red Men	479,033
Benevolent and Protective Order of Elks	442,653
Order of Eagles	400,000
Royal Arch Masons	422,359
Ancient Order of United Workmen	350,000
Knights of Columbus	346,500

Order of Owls	346,754
The Maccabees	331,756
Ancient Order of Hibernians	250,000
Royal Arcanum	244,722
Knights Templar	237,368
Foresters of America	205,756
Independent Order of Foresters	218,074

FRATERNITY, *fra ter' ni ti,* from the Latin word for *brother,* is the name of a society of college or university men for social or literary purposes. A similar organization for women students is known as a *sorority,* from the Greek word for *sister* (see SORORITY). Both are commonly called "Greek-letter Societies," because each organization takes its name from the initials of the two or three Greek words forming its secret motto.

Origin. The parent of the fraternities is *Phi Beta Kappa.* It was founded by five young men, students in the College of William and Mary, of Virginia, as long ago as the stirring days of 1776. They took as their motto, "A happy spirit and resolution of attaining the important ends of society." Branches were soon established at Yale and Harvard, called respectively the *Alpha of Connecticut* and the *Alpha of Massachusetts,* Alpha conveying the idea of *first.* In 1780, however, the parent society discontinued its meetings, for the Revolutionary War was at the very doors of the college. In the confusion of the times its secrets came to outside ears, and little by little its character changed, until to-day it is a purely *honorary fraternity* and not a secret society. Membership in *Phi Beta Kappa* is considered one of the greatest distinctions that can be conferred on the college student, since only those are admitted who achieve high standards of scholarship and are known to possess excellent character.

Organization. Some fraternities are merely local in character, while others are national, with many affiliated branches called *chapters.* Some of the older fraternities have as many as seventy-five or more chapters, and the tendency is for the newer organizations to combine with those that are firmly established. A chapter of a general or national fraternity may be formed in any college or university, but there can be only one chapter of the same fraternity there, and a student may belong to only one fraternity. Each year, as a rule, the fraternity holds a general convention to which the various chapters send delegates. At these conventions elections are held and all laws for the government of the fraternity are passed. The affairs of the fraternity are in charge of an executive council, which is usually incorporated and in whose name all property is held. Many of the larger fraternities maintain *chapter houses* at the chief universities. While some of these are merely for holding business and social meetings, others are conducted on the same lines as any of the large clubs for men, and provide living accommodations for members.

Views Regarding Fraternities. There has been considerable difference of opinion regarding the fraternity feature of college life. In the past many universities even had anti-fraternity laws, but in nearly all cases these have now been repealed. Those who oppose the fraternities do so on the ground that they lead to snobbishness, tend to create class distinctions, and therefore are out of harmony with the democratic spirit that should rule the American or Canadian university. They maintain also that fraternities constitute cliques which try to run college politics for the benefit of their members, that their very secrecy is harmful, and that they are crowding out the fine old literary societies that were once the distinction of the individual colleges.

Those favoring the fraternities point to the fine spirit of fellowship and sympathetic interest that compensate the student, in a measure, for the absence of home life. By bringing together those who have interests in common, the fraternities are helping to lay the foundations of many a friendship that will enrich life long after college days are over. It is argued, too, that the fraternities are a real aid to good college government, since each member feels a personal responsibility for the good name of his chapter and is anxious that it should stand well with the faculty. It is also true that the fraternities do much to keep alive the traditions of a college or university and to create loyal alumni. It is the general belief that dissipation is declining and scholarship improving in the fraternities in all strong colleges and universities.

Whatever may be the objections to the fraternities, it is certain that they are growing in strength year by year and are fast becoming the most important factor in American college life, so far as the social side is concerned. At the present time Yale is the only great university that excludes them.

High School Fraternities. In recent years there has been a marked tendency among high school students to form secret societies modeled on those of the colleges. The high

school organizations, like those of the colleges, are Greek letter societies; secret initiation rites are practiced, and secret rules adopted. Because of the immaturity of the students, educators as a rule strongly object to such societies, claiming that they foster the clique spirit and are harmful to the development of a feeling of school loyalty. In many cities, the school boards expressly forbid the organization of high school fraternities, and in some states they are prohibited by law. L.M.B.

FRAUD, in law, comprises all false representations or deceitful practices which have for their object defrauding or gaining unfair advantage of another. Fraud is arbitrarily punished according to the laws of the state or province wherein the act is committed, but no action can be maintained unless damages can be proved.

Fraud is said to be *actual* or *constructive.* Positive or actual fraud includes cases of intentional misrepresentation used to accomplish a purpose which is illegal. Legal or constructive fraud includes such acts or contracts as have a tendency to deceive or mislead others. Any contract or instrument in writing may be declared void if induced through fraud, and if both parties act fraudulently neither can take legal advantage of the other's acts. The Statute of Frauds, enacted in England in 1673, has been recognized of such importance that every state in the American Union and the provinces of Canada have practically reënacted it and made some of its provisions even more stringent.

FRÉCHETTE, *fray shet',* Louis Honoré (1839-1908), a French-Canadian journalist and poet, generally acknowledged as the greatest poet of his race. Though his first volume of poems appeared in 1863, when he was only twenty-four years old, he was for many years better known as a journalist than as a poet. In fact, it was not until he had reached middle life that he gave up active newspaper work and devoted himself to literature.

LOUIS H. FRÉCHETTE

Fréchette was born at Lévis, Quebec, attended Quebec Seminary and Laval University, and in 1864 was called to the bar. As the law, however, was not particularly attractive to him, he founded the *Journal de Lévis,* a newspaper in which he expressed such revolutionary views on public affairs that Canada no longer seemed a safe place for him. From 1866 to 1871 he did newspaper work in Chicago. Then, returning to Canada, he practiced law until 1879, when he again became the editor of a newspaper. He served in the Dominion House of Commons from 1874 to 1878, but was defeated for reëlection, and was again defeated in 1882, thereafter taking no active part in politics. At one time he was strongly in favor of the political union of Canada and the United States, but later in life became less enthusiastic over the plan.

Fréchette's poetry is strongly lyrical, and shows the inspiration of natural beauties, of friendship and family ties. Through all of it, moreover, runs a strong patriotic strain, a sympathy for the race which regards him as its representative poet. Among his many volumes of verse may be mentioned *Veronica,* a drama; *Mes Loisirs,* his first book; *La Voix d'un Exile,* a satire written in 1867 and directed against the Canadian government; and *Les Oiseaux de Neige,* which received the laurel crown of the French Academy. He also wrote two historical dramas, *Papineau* and *Felix Poutré,* and a number of essays and prose sketches, and he translated into French William D. Howells' *Chance Acquaintance* and George W. Cable's *Creole Days.* G.H.L.

FRED'ERICK, the name borne by three Prussian kings, the third of whom also ruled as emperor of Germany.

Frederick I (1657-1713) was the first sovereign to wear the crown of Prussia, and though his reign was uneventful, the creation of the new royal title was an important landmark in the history of Germany and of Europe. He was the son of Frederick William, the Great Elector of Brandenburg, and succeeded his father as elector in 1688. He realized his great ambition, to rule as king of Prussia, by giving aid to the Emperor Leopold I in the War of the Spanish Succession, and was crowned in 1701. Frederick was the friend and patron of learned men, and the founder of the University of Halle.

Frederick II (1712-1786) is known in history as Frederick the Great, and his name is associated with the most important events of his time. He was the son of Frederick William I of Prussia and Princess Sophia of Hanover,

sister of George II of England. In the first year of his reign (1740) he marched an army into Silesia, one of the fairest provinces of Maria Theresa of Austria, an act which brought on the great European conflict known as the War of the Austrian Succession. After eight years of warfare a peace treaty was signed at Aix-la-Chapelle, the terms of which have been aptly summarized by Carlyle, Frederick's biographer, in these words: "To Frederick, Silesia; as to the rest, wholly as they were."

FREDERICK THE GREAT
He sent a note accompanying a gift to George Washington in which he testified to the genius of the great American in these words: "From the oldest general in Europe to the greatest general in the world."

During the next few years Frederick devoted himself to the improvement of the Prussian military system and the development of his country's resources. In the meantime, however, Maria Theresa was taking steps to recover the territory she had lost in the previous war, and she succeeded in forming an alliance with France, Russia, Sweden and many of the Germanic states, for the humbling of her Prussian enemy. Frederick, though half of Europe was leagued against him, anticipated the movements of his foes by invading Saxony (1756), and the Seven Years' War (which see) began. This terrible conflict ended, in 1763, with the Treaty of Hubertsburg, which left Silesia still in the hands of Frederick. Prussia emerged from the struggle the equal of Austria, and the foundation was laid for the union of the German states and the formation of a great empire.

About ten years after the close of the Seven Years' War, Frederick joined with Catharine II of Russia and Maria Theresa in what is known as the First Partition of Poland, thereby making an important addition to his dominions. His whole policy was directed toward the upbuilding of the Prussian state, but he was as great in peace as in war. The years following the Peace of Hubertsburg were given up to the development of the material prosperity of his kingdom. He built roads and canals, encouraged manufactures and agriculture and brought the administration of the government to a high degree of efficiency. His own tastes were those of a philosopher and a poet, and he gathered about him the most distinguished men of his time. Among these was the great French writer, Voltaire.

Frederick III (1831-1888), the only son of William I, king of Prussia and first emperor of united Germany, succeeded his father in March, 1888. Three months after his accession he died. During the reign of his father he took an important part in the affairs of state, and he was in personal command of troops in the Seven Weeks' War with Austria in 1866 and in the Franco-German War. Frederick was a man of cultivated tastes and a believer in government by parliament. He was succeeded by his son, Emperor William II, the present ruler of the German Empire.

Related Subjects. The reader is referred to the following articles in these volumes:

Bismarck-Schönhausen	Poland
Franco-German War	Prussia
Frederick William	Seven Weeks' War
Maria Theresa	Succession Wars

FREDERICK I, surnamed BARBAROSSA, or RED BEARD (1122-1190), succeeded his uncle, Conrad III, as king of Germany in 1152, and was crowned Holy Roman Emperor in 1155. During the greater part of his reign he was engaged in a struggle with the powerful Italian cities which were joined together in a union known as the Lombard League. In 1176 his forces were overwhelmingly defeated on the field of Legnano, and in 1183 the emperor concluded with the League a peace treaty which granted the cities the right to manage their domestic affairs.

In 1189, having proclaimed peace in all his dominions, he set out on a crusade to the Holy Land (see CRUSADES). After defeating the Mohammedans in two battles, he was drowned while crossing a small stream in Asia Minor. The news of his death brought the greatest sorrow to his German subjects, who had come to look upon him as the highest representative of the ideal of German nationality. In the course of time a legend sprang up that some day he would return to earth to make the German people a strong and united nation.

FREDERICK VIII (1843-1912), king of Denmark from 1906 until 1912, was the son and successor of Christian IX. During his brief and quiet reign he gained the sincere affection and respect of his people because of his kindly manner and democratic ideals. He was a man of cultivated and scholarly tastes, and at one

time was chancellor of the University of Copenhagen. He was a brother of Queen Alexandra of England and of King George I of Greece, and his second son, Charles, became the ruler of Norway in 1905 with the title Haakon VII. Frederick was succeeded by his son Christian X.

FREDERICK WILLIAM (1620-1688), commonly called the GREAT ELECTOR, who as ruler of Brandenburg from 1640 to 1688 laid the foundations for the greatness of Prussia (see BRANDENBURG; PRUSSIA). When at the age of twenty he succeeded his father as elector he found Brandenburg sadly desolated by the ravages of the Thirty Years' War, and at once began to regulate the finances, to repopulate the deserted towns, and to create a standing army. For several years he was engaged in warfare against Louis XIV of France and the Swedes, defeating the latter in a decisive battle at Fehrbellin (1675). After concluding peace with his enemies he devoted himself to the interests of his people. He encouraged the industries, opened up canals, established a postal system, reorganized the universities of Frankfort and Königsberg and founded the Royal Library at Berlin, leaving to his son Frederick, in 1688, a prosperous country and a well-filled treasury. See ELECTOR.

FREDERICK WILLIAM, the name of four kings of Prussia, three of whom were of outstanding importance.

Frederick William I (1688-1740) succeeded his father, Frederick I, in 1713. He established an admirable system of administration, strengthened the financial condition of the country, and organized and drilled a splendid army of 80,000 men. To satisfy his love for tall soldiers, he resorted to most outrageous methods to secure them, forcing such men into his service by kidnaping them. During his reign a large part of Pomerania was wrested from Sweden and annexed to Prussia.

Frederick William III (1770-1840), who came to the throne in 1797, was the son and successor of Frederick William II. During the first part of his reign he refused to enter the coalition of the nations against Napoleon, but finally yielded to the demands of his people and sent an army against the great conqueror. In 1806 his forces were overwhelmed by the French at Jena and Auerstädt, and in 1807, by the Treaty of Tilsit, he was forced [illegible]de one-half of his dominions to France, [illegible] the half that remained became in real- [illegible] province of Napoleon's empire. The next few years were a period of regeneration for humiliated Prussia, and it was one of Frederick William's generals, the famous Blücher, who saved the day for the allies at the Battle of Waterloo, where Napoleon suffered his last defeat. After the conclusion of peace Frederick William joined with Czar Alexander I and Emperor Francis of Austria in the formation of the HOLY ALLIANCE (which see). Though he was opposed to popular liberty, he contributed to the material prosperity of his people, and during his reign the German customs union (see ZOLLVEREIN) was established.

Frederick William IV (1795-1861), son of Frederick William III, succeeded to the throne in 1840. During his reign Prussia joined the ranks of liberal states, for in 1848, the year of popular uprisings throughout Europe, he yielded to the demands of his subjects, who had risen in arms in Berlin, and agreed to grant them a constitution. Though the constitution finally adopted greatly restricted the liberties of the people, it marked the beginning of a new political system for Prussia. In 1857 Frederick William began to suffer from attacks of insanity, and in 1858 the government was placed in the hands of his brother William, the heir apparent, who succeeded him in 1861. See GERMANY, subtitle *History;* PRUSSIA.

FREDERICK, MD., a city of historical interest, made famous by the poet Whittier as the scene of Barbara Frietchie's patriotic act (see BARBARA FRIETCHIE). It is the county seat of Frederick County, and is situated in the northwestern part of that portion of the state which lies east of West Virginia. Washington, D. C., and Baltimore are respectively fifty-seven and sixty miles southeast, and York, Pa., is fifty-six miles northeast. The Baltimore & Ohio Railroad, constructed to the city in 1831, and the Pennsylvania Railroad, built in 1871, serve the city. The Hagerstown & Frederick Railway (electric), constructed in 1904, connects with towns to the north, west and south. The population in 1916 was estimated to be 11,112; in 1910 it was 10,435.

Frederick is an industrial city of importance, possessing large canning establishments, flour mills, brick works, planing mills and manufactories of tobacco products, hosiery, leather and coaches. Its canning factories furnish large supplies to the United States government; the second largest flour mill in the United States, one of the largest brush fac-

tories, and a $200,000 abattoir plant are located here. Besides its public schools the city has the Women's College (Reformed Church), organized in 1893; Hood Seminary, Boyd Academy, a convent and a library.

Frederick was settled in 1745, was incorporated as a city in 1817 and named for Frederick, Prince of Wales, son of George II.

The remains of Francis Scott Key, author of *The Star Spangled Banner,* lie in Mount Olivet Cemetery, and the entrance bears a striking monument erected to his memory. Frederick is also the burial place of Roger B. Taney, American jurist and statesman, and of Barbara Frietchie. In the vicinity the "first Methodist church in Maryland and in America" was organized in 1764 by Robert Strawbridge. O.C.W.

FRED'ERICKSBURG, BATTLE OF, an important engagement of the War of Secession, took place at Fredericksburg, Va., December 13, 1862, between the Federals under General Burnside, numbering about 113,000 men, and the Confederates, numbering about 78,000 men, under General Lee, aided by Jackson and Longstreet. After his retreat from the North following his defeat at Antietam, Lee established himself on the high bluffs overlooking Fredericksburg, on the south side of the Rappahannock River, a well-fortified position. Burnside was stationed at Falmouth, on the opposite side of the river. On December 12 the latter crossed the river with his army in three divisions, and on the following day advanced against Lee on Marye's Heights, withdrawing after six ineffectual assaults. His loss was 12,500 men, against the Confederates' 5,400. As a result of this defeat, Burnside was removed from the command of the Army of the Potomac.

FRED'ERICTON, capital of the province of New Brunswick, Canada, situated on the Saint John River, eighty-four miles from its mouth and sixty-seven miles northwest of the city of Saint John. It is well located and is protected on three sides by a range of hills. Large seagoing vessels navigate the river to Fredericton, and smaller vessels penetrate about seventy miles farther into the interior. Lumbering is the chief industry, but the city has important manufactures of boots and shoes, especially the "shoepacks" of rough tanned leather worn by lumbermen. Canoes and motor boats are also made and there are iron foundries and tanneries. The town was founded in 1740, when it was named Saint Anne. In 1786 the name was changed to Fredericton, and two years later it became the capital of the province. Population in 1911, 7,208. R.H.S.

FREE CITIES, the name applied to certain cities of Germany, which gained complete independence in the twelfth century by assistance given the emperors in repressing the arrogance of the nobles. In return for this help they received certain privileges and immunities and became imperial cities. The most important privileges were that they should enjoy free government; should never be forced to swear allegiance to any emperor or king, nor become engaged in any expedition against the Romans, or in any way to be reckoned among the cities of the empire. The only free cities now existing are Hamburg, Lübeck and Bremen, each sending members to the legislative body of the German Empire. At the time of the French Revolution there were fifty-one free cities; but with the exception of the three cities named they have all been deprived of their privileges as a result of various political changes.

FREEDMEN'S BUREAU, a Bureau organized by an act of Congress March 3, 1865, for the supervision, temporary maintenance and employment of the emancipated negroes of the South, who were left homeless and penniless after the War of Secession. It was headed by a commissioner, with assistant commissioners in all the states that had been a part of the Confederacy; these issued supplies to destitute negroes, had charge of abandoned lands to lease and ultimately to sell in forty-acre plots, and they also controlled all matters relating to refugees and freedmen. The Bureau continued its work until 1870 and expended over $15,000,000. It was one cause of continuing the enmity of the South toward Congress, for it led to the gathering of idle and worthless negroes around the Bureau depots, and so caused great hardship to the planters who could not secure laborers to pick their cotton.

FREEMAN, MARY E. WILKINS (1862-), an author of short stories and novels which portray the humor and pathos of the everyday life of the people of New England. Mrs. Freeman was born in the village of Randolph, Mass., and has an intimate knowledge of and deep sympathy with the lot of her characters. The plot in her stories is not so important as the strong delineation of character and the pictures of bits of human nature; country women in the grim routine of colorless days, weather-worn farmers with their touches of

awkward gallantry; children with their little pleasures and heartaches, and so on. *Pembroke* (1894) is regarded by literary critics as Mrs. Freeman's best work, although *The Portion of Labor,* a story of a labor strike in a mill town, is a masterly production. She was married in 1901 to Dr. Charles M. Freeman, of Metuchen, N. J.

MARY E. WILKINS FREEMAN

FREEMASONRY. See MASONRY, OR FREEMASONRY.

FREE METHODISTS, a religious sect, an offshoot from the Methodist Episcopal Church. The Free Methodist Church was organized at Pekin, in Western New York, August 23, 1860. Its founders were preachers who believed that the parent Church was departing from fidelity to the clear doctrines and simple usages of Wesley. The Free Methodists were distinguished for a time as *Nazarites,* which indicated an assumption of higher piety and holiness than the members of the parent Church. They insisted on plain dress and address, and that the members should shun what are commonly known as worldly practices, vices and pleasures. They prohibited the use of intoxicating liquors and tobacco, and tried to get back to the old fountain-spring of Methodism. In these respects they are more radical than members of any other Protestant body. The zeal of the Free Methodists is shown in their shouting, by lengthy addresses at religious meetings and in giving "testimony" to the saving grace of the Redeemer. In 1889 their preachers numbered 600, traveling and local. Their membership is now about 30,000, and their churches about 1,000 in number. They have two seminaries, one at North Chili, N. Y., and one at Spring Arbor, Mich.

FREEPORT, ILL., the county seat of Stephenson County, in the northwestern part of the state, is twenty-eight miles west of Rockford and 113 miles west by north of Chicago. It is on the Pecatonica River and is served by [illegible]llinois Central; the Chicago & North [illegible], and the Chicago, Milwaukee & Saint [illegible]ilroads, and by an electric interurban [illegible]Rockford. In 1910 the population was 17,567; it was 19,568 in 1916, by Federal estimate.

The city has a Federal building, a Y. M. C. A. building, erected at a cost of $110,000, a library and Saint Vincent's Orphanage. The manufactures include automobiles, buggies, gasoline engines, hardware, windmills, agricultural implements, pianos, organs, medicines and toys.

Freeport was settled in 1835 and incorporated in 1859, and it became a city in 1885. One of the famous Lincoln-Douglas debates was held here in 1858.

FREE PORTS, a name given to certain cities on the seaboard where no customs duties are levied and where no customs supervision exists. Ships may enter, on payment of a moderate toll, and may load and unload in these ports. Cargoes are deposited and handled, and goods are bought and sold without action on the part of taxing authorities.

In Great Britain free ports have never existed; in 1552 it was planned to place Hull and Southampton on this footing, but the plan was abandoned. In Denmark, an area of about 150 acres at Copenhagen was opened as a free port in 1894 to attract the trade of the Baltic seaports. In Germany, since 1888, only Hamburg remains a free port. An area of about 2,500 acres is exempt from customs duties and supervision. Sulina, in Rumania, is a free port. In 1895 free ports were opened at Kola, in Russian Lapland. Malacca, Penang and Singapore have been free ports since 1824, Hongkong since 1842, and Weihaiwei, China, since it was leased to Great Britain in 1898. Macao has been a free port since 1845.

In the United States there are no so-called free ports, but Congress has passed laws whereby customs duties need not be paid when imported goods are unloaded. Such merchandise, if not needed at once by consignees, may be placed "in bond" in government warehouses, and the duty may be paid when it is removed later.

FREE-SOIL PARTY, a political organization in the United States in the decade preceding the War of Secession, founded on opposition to the extension of slavery in the Territories and opposed to their later admission to the Union as slave states. It was organized in 1848 in Buffalo, N. Y., was strengthened by the support of Martin Van Buren and the Barnburners, and in the same year nominated Van Buren for the Presidency. The party polled nearly 300,000 votes, on the platform

"Free Soil, Free Speech, Free Labor and Free Men," and although it did not carry any state it elected fourteen members of Congress, and was strong enough to send Salmon P. Chase and Charles Sumner to the Senate. In 1852 the party strength was only half of what it had been in the preceding general election, owing largely to the defection of the Barnburners. In 1856 the Free-Soilers joined the newly-formed Republican party. See POLITICAL PARTIES IN THE UNITED STATES.

FREE'THINKER, a term applied to those who refuse to accept Divine revelation, and who feel free to adopt any opinion in religious or other matters which may result from their own independent thinking.

In the seventeenth century the name was claimed by those who took part on the anti-Christian side in the religious controversies. Anthony Collins (who first made it a name of a party by his *Discourse of Freethinking*) and his friend, John Toland, are among the chief of the early freethinkers. Lord Bolingbroke and Hume were among the leading later freethinkers. In France, Voltaire and the encyclopedists, D'Alembert, Diderot and Helvetius, are among those who argued for natural, as against revealed, religion. In the reign of Frederick the Great the same spirit became fashionable in Germany. Freethinkers to-day are unorganized, and their numbers appear not to be large. Voltaire is their inspiration. See VOLTAIRE.

FREE'TOWN, the principal seaport of West Africa, capital of the British colony of Sierra Leone and headquarters of the troops of the West African garrison. Until recent years the town was commonly referred to as "the white man's grave," for the climate was so unhealthful that few Europeans could live there. The surrounding swamps have now been drained and living conditions consequently have greatly improved. The natives are skilful in gold and silver work, and a large export trade is carried on in rubber, gold, palm oil, gums, nuts and ginger. The city is strongly fortified, has an excellent harbor and is a coaling station for vessels of the British navy patrolling the African coast. Population in 1911 37,724, of whom about 500 were Europeans.

FREE TRADE, in economics and government, is the name given to the policy which aims to encourage the greatest possible commercial intercourse between the various nations of the world. This policy teaches that the exchange between nations ought not to be restricted by laws or tariffs that favor the home producer. A nation that adopts free trade does not give any assistance to the home industries, either in imposing customs duties on foreign products or by offering a bounty on home products. It means, in other words, that all the producers, either home or foreign, are treated exactly alike in the market of that country. The opposite policy, which maintains that a state can reach a high degree of material prosperity only by protecting its home industries from the competition of similar foreign industries, is known as *protection* (which see).

Great Britain is the only great industrial country of the world that has adopted free trade. Belgium and Holland have also tariffs that are only slightly protective. The rest of Europe, the United States and all the self-governing British colonies have adopted the policy of protection. Customs duties and taxes imposed for revenue purposes only are not opposed to the principle of free trade.

The Theory of Free Trade. Briefly, the economic principles on which free trade is based are stated from the standpoint of those who advocate it. The first and foremost of these is the well-known economic principle of the *division of labor* and the specialization and organization that accompany it. Division of labor in this case means that each country would be able to concentrate its energies in the production of those commodities for which it is best fitted by its natural resources, geographical position, skill of its inhabitants, and so on. But commodities are produced in order to be consumed or *exchanged* for other goods. There must therefore be the widest opportunity for each country to exchange its products for those of other countries. Free exchange, or freedom of trade, becomes therefore the necessary condition for the realization of this international division of labor. Foreign trade, just like domestic trade, is nothing else than an exchange of goods for other goods, in which both parties to the transaction are the gainers, for each of them obtains goods more desired than those with which it parted. Freedom of trade, which allows the capital and labor of each country to be used in those industries that are most suitable to that country, secures the greatest production of goods to the greatest advantage of the consumers.

The development of the material resources of the world and the production of wealth contribute to the welfare and to the progress

of mankind. Competition in the open market between the goods produced assures consumers the best and cheapest terms. As most men, in whatever branch of production they may be engaged, are consumers of a great number of purchased commodities, cheapness of these commodities is of the utmost benefit to them. As we see, free trade considers the question from the point of view of the consumer, and regards consumption of goods as the aim of all production.

To sum up, free trade maintains that in order to secure the greatest abundance of goods in the world as a whole and the greatest benefit to the consumer there ought to be complete freedom of trade between the nations. Those who believe in the policy of free trade urge that no artificial barriers, in the form of customs duties or other restrictions, should be erected which will interfere with the free exchange of goods between nations.

The economic principles on which free trade is based are undoubtedly sound, but it is a question whether this policy is desirable in the present state of unequal national development. Many who accept free trade as a final goal insist that its immediate application would retard the development of skill-using manufacturing industries in the less-advanced countries, and cause them to remain too long mere producers of food and raw materials, missing the greater rewards which skill and organization command.

Moreover, the conduct of nations is not determined simply by economic factors, however powerful these may be. Political and social considerations, such as national safety, national defense, national economic independence, as well as national hatreds and jealousies, play just as important a rôle in the choice made by a nation between the free trade and the protective system.

Under which system these aims could be best attained has formed the subject of fierce controversies, raging in almost every nation. For the present most countries cling to the protective system. For other arguments in favor or against free trade, see the article PROTECTION, in these volumes. E.A.R.

Consult Cunningham's *Rise and Decline of the Free Trade Movement;* Mathews' *Taxation and the Distribution of Wealth.*

FREE WILL, the power of human beings to [illegible] deliberate choice in matters of conduct. [illegible]t man is a free agent, able to [illegible]elf which of several possible courses of action he shall adopt. The opposite idea is that his choice is determined for him by a series of causes over which he has no control, such as outside circumstances, environment, heredity, moral influences, all his previous experiences and actions, his impulses, instincts, habits and other internal motives. This counter-theory is called *determinism,* and over the two doctrines philosophers have disputed long and fiercely from the time of the first thinkers down to the psychologists of to-day.

The controversy over *predestination* (which see) took up the religious phase of the question, but modern discussion concerns itself almost exclusively with the ethical aspect. Those who uphold the freedom of the will rest their case chiefly upon the argument that unless man is free to choose there is no value or purpose in moral law, and no justice in holding anyone responsible for his actions.

An analysis of the controversy on the subject shows that in discussing the arguments for and against free will the philosophers have had in mind no fewer than six different kinds of freedom, and much of the confusion can be traced to the attempt to prove one meaning of free will by facts properly related to an entirely different meaning. Inevitably, however, the question of free will is one on which there can probably never be perfect agreement. See WILL; HEREDITY.

FREEZ'ING, the process, not yet fully understood, which turns a liquid into a solid when its temperature is sufficiently lowered. Each substance has its own *freezing point,* which is always the same under ordinary conditions. Thus, the freezing point of water is always 32° Fahrenheit—a fact which is depended upon in making a thermometer. Except in mixtures and solutions, the freezing point of the liquid is also the *melting point* of the solid; so that ice again becomes water at a temperature of 32°. This is sometimes called the *point of fusion.*

All fluids do not freeze at the same temperature. Mercury, for instance, becomes solid at about 39° below zero F., and for that reason thermometers for exceedingly cold regions are made with alcohol instead of mercury, since alcohol does not freeze until it reaches a temperature of 202° below zero F. Salt water freezes at a lower temperature than fresh water. The approximate temperature at which sea water freezes, for instance, is 28.5° F., and the more salt there is in solution, the lower the freezing point drops.

While most substances contract when they freeze, it is a curious fact that water expands. This explains why water-pitchers sometimes crack and water-pipes burst on "freezing cold" nights. It accounts also for one form of erosion, for the moisture which has found its way into the crevices of rock freezes during the winter and expands, creating great fissures and breaking off pieces here and there. It is for the same reason that an iceberg floats; that is to say, since the water expands in freezing, ice is less dense than water and, being lighter, is naturally floated by the water around it.

Another interesting fact is that the freezing point is *lowered* by pressure. Therefore, when pressure is applied to ice it melts, although it freezes again when the pressure is removed. It is this quality of ice that enables us to enjoy the pleasures of skating. The narrow blade of the skate, bringing the entire weight of the body to bear down upon the ice, for the moment of contact melts a thin strip of ice beneath the blade. The surface water that results from the melting process makes the ice slippery, and the skater glides easily along. The same principle comes into play when a boy makes a snowball; the pressure of his hands melts the crystals, forming a film of water that freezes again as soon as the pressure is released.

Related Subjects. The reader is referred to the following articles in these volumes:

Erosion	Melting Point
Ice	Thermometer

FRE'MONT, JOHN CHARLES (1813-1890), an American explorer, soldier and political leader, who displayed remarkable initiative and energy as leader of several expeditions through the Rocky Mountain regions and westward to the coast, and whose investigations gave the United States government valuable information concerning the great unexplored Western country. He was born in Savannah, Ga., and was educated at Charleston College, South Carolina. In 1842, after several years of experience in the government-survey service, he was placed at the head of an expedition to the far west, and on this journey he ascended the highest mountain of the Wind River Range, now known as Fremont's Peak, in his honor.

The following year he led out a second expedition for the purpose of completing the survey to the mouth of the Columbia River, and sent to Washington valuable and interesting descriptions of Great Salt Lake, the Great Basin, the Sierra Nevada Mountains and the river basins of the Mexican province of California. In 1844 he was made captain, and the following year was commissioned by the government to lead a third expedition to California, the purpose of which was to help the United States gain possession of that province in the event of war with Mexico.

JOHN C. FREMONT
One of America's notable men in the middle of the nineteenth century.

Fremont took an active part in the conquest of California (see CALIFORNIA, subhead *History*), and was made military commander and civil governor of the territory by Commodore Stockton, the officer in command. In 1846, however, a United States force under General Kearny arrived, whose authority Fremont refused to recognize. For this he was court-martialed, and, having been convicted of mutiny and disobedience, was sentenced to dismissal from the service. Though President Polk remitted the sentence, Fremont felt that he had been deeply wronged, and in 1848 he resigned.

Later he conducted two other exploring parties over the Rocky Mountains, but without accomplishing anything of importance. Between 1849 and 1855 he made his home in California, and in 1850 was elected one of the first two Senators from that state. He was also the first Presidential candidate of the Republican party, being the unsuccessful opponent of Buchanan in the election of 1856. On the outbreak of the War of Secession he was raised to the rank of major-general and given command of the Western Department, with headquarters at Saint Louis. In this position, and in a second one to which he was transferred a few months later, he showed what his superiors considered lack of judgment and executive ability, and in 1864 he retired from active service. Fremont's most important work in the years that followed was his service as governor of the territory of Arizona, from 1878 to 1881. Shortly before his death he was appointed major-general on the retired list, by act of Congress. For an account of his labors, consult his *Memoirs of My Life.* B.M.W.

FREMONT, NEB., the county seat of Dodge County, is situated in the east-central part of the state, thirty-seven miles northwest of Omaha. It is on the Platte River and on the Chicago, Burlington & Quincy, the Chicago & North Western and the Union Pacific railroads. The area of the city is four square miles. In 1910 the population was 8,718; in 1916 it was 9,925, by Federal estimate. Fremont is in a farming section, has dairying and live-stock interests, and is an important grain market. Its industrial plants include machine shops and mattress and incubator factories. It is the seat of the Fremont Normal School, and has a courthouse, Carnegie Library and orphans' home (Lutheran). Fremont was settled in 1857, incorporated in 1871 and obtained a revised charter in 1901.

FREMONT, OHIO, the county seat of Sandusky County, is situated in the northwestern part of the state, thirty miles southeast of Toledo. It is at the head of navigation on the Sandusky River, has boat and interurban service, and is on the New York Central and the Wheeling & Lake Erie railroads. The area of the city is nearly four square miles. In 1910 the population was 9,939; in 1916 it was 10,882, by Federal estimate.

Fremont has several public parks, a state historical building and the Birchard Public Library, which was founded in 1873 by Sardis Birchard, an uncle of President Hayes. Spiegel Grove, in Fremont, was the home of former President Hayes. The town is situated in a productive agricultural region and is surrounded by rich oil and natural gas fields. Power for manufacture is obtained by a large dam and power plant, and among the principal industrial plants are manufactories of electrocarbons, machinery, boilers and engines, farming implements, cutlery, stoves and ranges, shears, paper, underwear, beet sugar and lumber products.

A trading post, erected in 1785, and Fort Stephenson, built in 1812, first occupied the site of Fremont. Until 1850 the place was known as Lower Sandusky, but that year it was given its present name in honor of John C. Fremont.

FREM'STAD, OLIVE (born about 1870), a dramatic soprano and tragic actress, a prominent member of the Metropolitan Grand Opera Company, New York City. By hard, persistent effort, for she always had to earn a living, she fought her way to the intellectual centers of the world. She was born at Stockholm, Sweden, and in her native country at the age of five appeared as a concert pianist, When she was ten years old her parents settled at Saint Peter, Minn., and later moved to Minneapolis, where she taught music and sang in choirs, putting aside her earnings to enable her to continue her studies. Hard work made a reality of her dream to complete her education in Germany, and in 1898 after three years of study she appeared in opera at the Cologne Opera House. She sang for over ten years at Munich, and then became a member of the Metropolitan Opera Company, New York. She has sung in leading cities of the United States and Canada in many notable operas, although her greatest triumphs have been achieved in Wagnerian rôles. In November, 1916, Miss Fremstad was married to Harry Lewis Brainerd, of New York City, and there she makes her home.

OLIVE FREMSTAD

FRENCH ACADEMY, or **ACADEMIE FRANÇOISE.** See ACADEMY.

FRENCH, ALICE (1850-), an American author of short stories, whose pen name is OCTAVE THANET. *The Bishop's Vagabond,* published in *The Atlantic Monthly* in January, 1884, forms the cornerstone of Miss French's fame. It was the author's first attempt to portray Southern character. Her style shows an unmistakable masculine tendency, and her interests are half masculine. She has an extensive knowledge of the relations between capital and labor, and her interest in the subject is possibly deeper than that of any other woman writer in the land. Her earliest work was some very heavy essays on questions of sociology. She spends a part of every summer at Cape Cod, and it was there that she acquired considerable skill in photography. *An Adventure in Photography* is illustrated by actual photographs of the adventurers, taken by the author. As she has lived in the West and in the South, her portrayals of life in those regions are very real. Among her short stories are *Otto, the Knight* and *Knitting in the Sun.* Among her later works are *The Man of the*

Hour, which has been dramatized, and *The Lion's Share.*

FRENCH, DANIEL CHESTER (1850-1912), an American sculptor, the record of whose splendid achievements, always inspired by the highest ideals in art, is unique in the history of American sculpture. He was born at Exeter, N. H., and began his career by modeling animals and birds. Louisa May Alcott early recognized his ability and became his first critic. At the age of twenty-three he completed his first important work, *The Minute Man,* for the centenary of the Battle of Concord. This was soon followed by many significant portrait statues, including those of *John Harvard* and *Lewis Cass,* and the *Gallaudet Monument* at Washington. His memorial statue of *Washington* was commissioned by the women of America and erected in Paris. *Death Staying the Hand of the Sculptor,* a memorial relief for the tomb of the sculptor Martin Milmore, in Forest Hills Cemetery, Boston, is considered his greatest work. His colossal statue of *The Republic* was one of the best pieces of sculpture at the Chicago World's Fair of 1893. These are but a few of the monumental works of this celebrated worker in the plastic arts.

FRENCH AND INDIAN WARS. The claims of the English and French settlers in North America were from the outset conflicting. Those who planted colonies on the seaboard, announced the English, had a right to all the land that stretched inland from those points; the French claimed that settlement at the source or the mouth of a river conferred a title to all territory which the river drained. Carrying out these theories, the English pressed westward from the Atlantic coast, the French southward from Canada and northward from Louisiana, and conflict was inevitable. It might have been but a colonial affair had it not been that the two countries were at swords' points in Europe as well; the most serious struggles were in Europe, and the American conflicts were really outgrowths of these. They are known as the French and Indian Wars, because the French in every case had the Indians as allies.

King William's War (1689-1697). This first struggle bears the name of the sovereign who but a year before its outbreak had come to rule in England. Its European phase was known as the WAR OF THE GRAND ALLIANCE. In America it began with the sending of French expeditions from Canada against the English frontier. Hundreds of settlers were captured or killed, sixty falling in the little town of Schenectady, but all the English expeditions against Canada except one failed almost before they started. Finally the war came to an end, not because anything had been decided, but because a treaty of peace had been signed in Europe. By this treaty the French surrendered all territory in America of which they had gained possession during the war.

Queen Anne's War (1701-1713). This was an outgrowth of the great European conflict known as the WAR OF THE SPANISH SUCCESSION (see SUCCESSION WARS), in which France had the assistance of Spain. Thus English colonists both in the North and in the South were attacked, the former by the French from Canada, the latter by the Spaniards from Florida. In the north the outstanding event was the attack on Deerfield, Mass., by the French and their Algonquin allies. Perhaps the French leaders could not control their savage helpers, perhaps they did not try; at any rate, in February, 1704, the town was sacked, fifty-three were killed and 111 made prisoners, of whom seventeen were later put to death. The English also, in 1710, took Acadia, which they rechristened Nova Scotia and have ever since continued to hold. In the South the conflict consisted of attacks on Saint Augustine by the English and counter-attacks on Charleston by the Spaniards. The Treaty of Utrecht (1713), which closed the war, ceded to England the Hudson Bay region, Newfoundland and Nova

Scotia, and allowed to it the monopoly of the slave trade in the colonies.

King George's War (1744-1748). This, too, was related to a great European conflict, the WAR OF THE AUSTRIAN SUCCESSION (see SUCCESSION WARS). Again the Spaniards were the allies of the French and Indians, and the war in the South was between the colonies of South Carolina and Florida. It was in the North, however, that the main issue was fought out. The colonial forces of New England, under William Pepperell, took the French fortress of Louisburg, on Cape Breton Island, and all the efforts of the French and Indians did not effect a recapture of it. When the Treaty of Aix-la-Chapelle was signed in 1748, however, it gave Louisburg back to France, contrary to the wishes of the New Englanders, who were proud of their conquest.

French and Indian War (1754-1760). The three conflicts described above had made almost no change in the divisions of American territory, and had left the main issues undecided. It remained for this last struggle, more specifically known as the French and Indian War, to effect a permanent settlement. In Europe this fight to the death was known as the SEVEN YEARS' WAR, and involved practically all of the great powers, while one phase of it was fought out in far-away India. In America, especially determined were the French to maintain their hold on the lands watered by the Ohio, and to these the English were equally determined to assert their claim. In 1754 the governor of Virginia sent out at the head of a small force a young man who had proved his courage and his wisdom—George Washington—and he demanded of the French that they withdraw from the contested territory. Naturally the French refused, and in the conflict which followed, the first gun of the war was fired.

Braddock's Expedition. Meanwhile, the French had erected a fort called Duquesne, at the junction of the Allegheny and Monongahela rivers, and in 1755 General Braddock was sent with a force of English regulars to dislodge them. Refusing to listen to the advice of his young subordinate, Washington, who knew the Indian methods of fighting, Braddock led his force boldly through the woods, where it was attacked from ambush and utterly de-ed. Braddock was killed, but Washington eeded in leading a part of the troops to y. In the same year the English were ccessful in two other expeditions, one against Crown Point and one Niagara. One thing the British ever, and that was to exile from of Acadia, or Nova Scotia, the F whose loyalty was doubted, ar incident which Longfellow has effectively in his *Evangeline*.

The English Win. Not unti English begin to retrieve their new English prime minister, Wi into operation a thoroughly er and the war was prosecuted witl soon brought it to a close. I Duquesne, Crown Point and N before the English; and in Se occurred the final conflict witl ending—the Battle of Quebec. by storm the city which was French under Montcalm with hi the English General Wolfe beg finally led a part of his force t Abraham above the city. Th followed was a turning point in tory, and has been ever sinc events over which boy readers pore, thrilled by its records of h Quebec fell the long struggle w land was to be supreme in N The Treaty of Paris, signed in 17 country Canada and all the Fre east of the Mississippi, together ish territory of Florida, while from France all of its lands we sissippi, with the "Isle of Orle the city of New Orleans. The of its colonial empire left to F tiny islands, Saint Pierre and M of Newfoundland, which it was a as fishing stations on condition main unfortified. England had rival in America but Spain.

Consult Parkman's *Montcalm* Wood's *The Fight for Canada.*

Related Subjects. The reade the following articles in these vo

Paris, Treaties of	Quebec,
Pitt, William	Successi

FRENCH GUIANA, *ge ah' na, ka' en,* a French colony in Northe ica which costs France over a each year to maintain as a settl victs. The Atlantic Ocean was northern shore; on the east the separates it from Brazil, as do Tumac-Humac Mountains on th

the western boundary, and separating French Guiana from Dutch Guiana, flows the River Maroni, or Marowijne. With its 30,463 square miles, it is about the size of South Carolina, but it supports but 49,000 people, less than one-thirtieth of the population of that state. French Guiana is often called CAYENNE, after its capital and only port, on an island of the same name.

LOCATION MAP
The position of French Guiana in South America. The map shows the relatively small portion of the continent it occupies.

The Land and Climate. From a fertile but hot and moist coast region, subject to fever and various germ diseases, French Guiana rises into a well watered highland and mountainous region excessively rich in vegetation. Most of the country is still unexplored, however, for the diseases bred by continuous moisture make the country almost uninhabitable. At Cayenne is the only desirable harbor. Northwest of Cayenne lies Devil's Island, famous because the French artillery officer, Alfred Dreyfus, was imprisoned there (see DREYFUS, ALFRED).

Resources. Gold mining is the colony's most important industry, and gold is the chief article of export. Nevertheless, the price of labor is so high, and transportation, chiefly over poorly made footpaths, is so costly, that even that industry is not highly developed. Over two million dollars worth of gold are exported yearly. Small quantities of silver, iron and phosphate are also produced, and some marble and rosewood oil are exported, as well as sugar, rum, vanilla, pepper, cloves, cinnamon, hides, etc. The imports exceed the exports. Rice, maize, cocoa, coffee, etc., are raised, but manioc is the principal article of food. Not quite 10,000 acres of land are under cultivation.

Government and Education. The government is vested in a governor appointed at Paris, assisted by a local privy council of five members and a council-general of sixteen members. The colony is represented in the Parliament of France by one deputy. A court of first instance, a court of appeals and justices of the peace in Cayenne administer justice. About 3,000 children are instructed each year in about thirty schools. In Cayenne there are a college, a museum and an unusually complete library.

COMPARATIVE AREAS
French Guiana is 568 square miles larger than the state of Maine.

Transportation and Communication. Although steamboats ply between the capital and other towns, and a few roads connect the capital with the interior, intercourse is chiefly by footpath. A cargo boat from France visits the colony once a month, and Cayenne and Brest, France, are connected by cable.

History. In 1604 the French first settled at Cayenne, and in the years following various French companies attempted colonization, but without success. From 1654 the Dutch held the land, but twenty years later the colony passed under the control of the crown of France, and slow growth and progress followed. With a view to still further growth in 1763, 12,000 emigrants were sent to French Guiana from France. The expedition was mismanaged, however, and within two years only a handful of the colonists were still alive, and they were starving and fever-stricken. Further attempts at colonization also ended disastrously.

In 1809 the colony was captured by British and Portuguese forces, but was restored to France in 1814, after Napoleon's downfall. The boundary with Brazil, long disputed, was finally settled in 1900. The boundary with Dutch Guiana was settled in 1905. Only political offenders and criminals are now sent to the colony, and it is held by France at a financial loss. M.S.

Consult Redway's *In the Guiana Forest;* also his *Guiana.*.

FRENCH IN'DO-CHI'NA, the collective name of the French possessions in the southeast of Asia, including Tongking, Annam, Laos, Cambodia, Cochin-China and Battambang. There is a combined area of 256,200 square miles, almost as large as the state of Texas and about the same size as the province of Alberta. The northern boundary adjoins

China; on the west is Siam and on the east and south is the China Sea. In 1900 the Bay of Kwang Chow Wan, with its islands and a strip of coast land, was leased by the French from China for a period of ninety-nine years and incorporated in French Indo-China.

The seat of government is at Saigon, in Cochin-China. The provinces are administered by a governor-general, appointed from Paris, with a governor in charge of each province. French influence over Indo-China commenced in the seventeenth century. Annam and Siam were visited by many missionaries, who were well received. In 1774 the king of Annam appealed to France for help against his rebellious subjects. French forces established him on his throne in 1802, and from that time French influence has steadily increased. Total population, about 18,000,000. For map, see ASIA.

Related Subjects. The reader is referred to the following articles in these volumes:

Annam	Cochin-China
Cambodia	Tongking

FRENCH LANGUAGE, one of the eight Romance languages of Europe (see ROMANCE LANGUAGES), a beautiful, harmonious tongue which is so commonly used in interstate diplomacy in Europe that no young man thinks of entering the diplomatic service without a knowledge of it. It has always ranked as the most "elegant" and "refined" of the languages, and few girls in England or America have been allowed to graduate from fashionable finishing schools without at least a superficial acquaintance with it. But this does not mean that it is in any way superficial, for few tongues surpass it in expressiveness, harmony and clearness. It is the native speech of over 40,000,000 people, for it is used in most of France, in part of Eastern Canada, and in much of Belgium and Switzerland.

History. Like all of the highly evolved languages of the world, French has had a very interesting history. The people Caesar found in Gaul at the time of his conquest spoke a rude Celtic language, the different tribes possessing different dialects. Gradually Latin took the place of the old Celtic, but this was not the classic Latin of Rome, but the so-called "vulgar tongue." This was modified still more by Celtic habits of speech and by Teutonic invaders who later conquered the country. It [illegible] that these latter introduced many of [illegible] words, but their half-barbarous minds [illegible] be bothered with any intricacies of speech, so inflections were neglected and the simpler forms used almost exclusively. The last of the Germanic invaders were the Franks, from whom the country and the language took their names.

In the ninth and tenth centuries two distinct dialects of the Romance language in France came to be recognized, one of which prevailed in the north, the other in the south. To these were applied in popular speech the quaint names of *langue d' oïl* and *langue d' oc* because the word for *yes* was *oïl* in the north and *oc* in the south. By the twelfth century one of the *oïl* dialects, the one used in the neighborhood of Paris, had gained the ascendancy, and gradually it was accepted as the classical tongue throughout the country. During the sixteenth and seventeenth centuries the standards were more definitely fixed, and by the close of that period French was practically what it is to-day—probably the clearest and most precise of modern languages.

The Study of French. Ever since educators began to awaken to the fact that there is much to be gained from the study of modern languages, French has been one of the favorite tongues for study in English-speaking countries. It is attractive because it is an "elegant" tongue, musical and refined, and therefore the "finishing schools" took it up. Then, too, it opens up one of the world's greatest literatures—a literature which has profoundly affected that of England and America; and it is the speech of a country to which travelers from England and from America go in great numbers—two very practical reasons for the study of French. Aside from these, there are cultural reasons for its study. Its nicety and precision, and the exactness with which it can express varying shades of meaning, make it a real help toward the perception of such shades of difference. It is, too, better suited than any other modern tongue to show the historical development in language, so clearly marked are the successive steps from the original Latin. In fact, so thoroughly does French fulfil all the purposes of a language that it has a number of times been proposed as a general international speech.

Certain phases of the study of French are comparatively simple. It is, for instance, far easier to learn to read than German, so simple is its sentence structure. However, learning to speak French is a different matter. Not only are many of the sounds, as the very common nasal, the peculiar *u*, the *ieu*, and others, dif-

ficult for English-speaking lips, but the very decided lack of phonetic character and the frequent silent letters make for confusion. Thus a person may easily gather from two or three years' study in school a sufficient knowledge of French to read simple prose or poetry rapidly, but only association with French-speak French so that it really sounds like the French of the Parisian. A.MC C.

FRENCH LITERATURE. The writings which, to quote William Vaughn Moody, a speaking people can give him the ability to poet with a gift for apt description, are—

> Couched in the sweet, satirical,
> Impudent tongue of France,

are among the world's greatest productions. At times French literary art has dominated Europe, and the literatures of other countries have been but imitations, more or less feeble; and while this is not the case to-day, it is not because France has deteriorated but because other countries have developed more originality. The French philosopher Buffon once said, "The style is the man," and the statement comes most fittingly from a Frenchman, for in a very real sense it may be said the French literary style is France. This does not mean that the content has been neglected, but merely that the effort has always been to make the style worthy of the content and a fit expression of the artistic, beauty-loving French people.

Two of the greatest departments of literature are the epic and the tragedy, and in these France has not excelled. No great epic of the literary type (see EPIC) and but few really great tragedies have been produced by Frenchmen, but of exquisitely funny comedies, of charming musical verse, of novels that are beyond criticism, of polished essays, of short stories that are models of what the short story should be, France has contributed liberally to the world's literature. A detailed treatment of French literature throughout its long course is impossible in this article, which must serve rather to bind together the numerous biographies of French writers which are included in these volumes. Most of the authors here named are treated in a separate article, as well as many others, whose names will be found listed in the indexes, under the articles DRAMA; HISTORY; NOVEL; POETRY.

Early Stage. After the French language had been evolved from the Latin, the first literary productions were the so-called *chansons de geste*, or *songs of deeds*. These were folk epics which centered about the careers of great national heroes, chief among whom were Charlemagne and Arthur. Most famous of the Charlemagne cycle is the *Song of Roland*, which holds in French literature somewhat the place which the *Nibelungenlied* occupies in German or the *Cid* poems in Spanish. Out of the Arthur cycle have grown all those legends and poems so familiar to English readers, which treat of the Round Table.

During the Middle Ages—that is, from about 1100 to about 1400—the *troubadours* (which see) attained wide popularity and influence in the south of France, while in the north the *trouvères* found enthusiastic audiences for their love songs. In France, as in most countries, poetry grew up first, and prose had a slow development. The first form of prose which appeared was history, represented by the famous *Chronicles* of Froissart. Meanwhile, an intense interest in the stage was developing, and mystery plays were produced in great numbers and with much elaborateness. It was nothing unusual for a village to devote several days to a single religious drama.

The Golden Age. All of this was largely preliminary, and not until the sixteenth century did any really great figure stand out in French literature. Then appeared Rabelais, who with his good sense and "Homeric laughter" helped on that intellectual awakening which is known as the *Renaissance*. The Reformation in France is typified by Calvin, while the spirit of skepticism which grew out of the new questioning attitude found its best spokesman in Montaigne. The real Golden Age of French literature was the seventeenth century, and as the names of Molière, Corneille and Racine testify, the drama was supreme. The first-named of the trio is looked upon as the greatest laughter-maker the world has produced, with the exception of Shakespeare, while the others brought tragedy to a height which it has never since attained in France.

Not all the great writers of this period were dramatists. Lafontaine wrote his matchless fables, the only modern fables worthy to rank with those ancient ones credited to Aesop; Boileau, with his satires and criticisms, ruled literary France; Madame de Sévigné set a high standard for letter-writing; Fenelon produced a famous romance; and—of more interest to the children than are all the others together—Charles Perrault gave to the world the immortal *Mother Goose Stories*, which

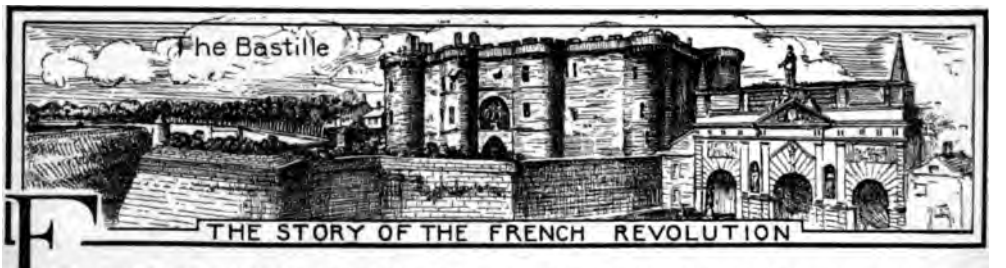
contained *Cinderella,* the *Sleeping Beauty, Puss in Boots, Tom Thumb* and other favorites. See MOTHER GOOSE.

From the Eighteenth Century to the Present. The eighteenth century was far below the seventeenth in the quality and amount of literary achievement. During the first half there was very little that could pretend to originality, while later in the century, when there arose writers of undoubted power and individuality, all France was so engaged with social and political problems that little save propaganda literature was demanded or produced. If one man were to be chosen to represent the century, that man would undoubtedly be Voltaire, and Voltaire's works were destructive rather than constructive. The current religion, the current philosophy, he attacked fiercely, and by his stirring up of the questioning spirit he did much to bring on that great outbreak which he did not live to see—the French Revolution. Even more influential in this direction was Rousseau, who, as one writer says, "provided most of the ideas which the Revolution tried to put in practice." Other outstanding writers of the eighteenth century were Montesquieu, who wrote on the philosophy of history; Le Sage, damatist and novelist; and Beaumarchais, the most important dramatic writer of the century in France.

The most significant literary movement of the nineteenth century was that toward freedom of literary form—the movement known as *Romanticism.* Chateaubriand, perhaps unconsciously, began it, but it reached its culmination in the works of Victor Hugo. As always, the tendency toward romanticism was carried too far, and the real merits of the movement were obscured by exaggerations, so that as a movement it had only a brief life, but it left its permanent impress on literature, lessening the formal restraints of classicism and imparting a new note of naturalness.

The French writers of note in the nineteenth century are numerous, and include Lamartine, Gautier, Sainte-Beuve, Musset, George Sand, Dumas (father and son), Balzac, Daudet, Zola and Maupassant. Each of these was preëminent in one or more ways. Balzac, for instance, is accounted by some critics the world's greatest novelist, while to Maupassant is conceded almost universally the honor of having produced the very finest short stories ever written; but Hugo towers above them all by reason of his versatility and his power to draw characters that live in men's minds. Though fiction in one form or another was perhaps the dominant literary type in the nineteenth century, other departments were well represented. Sardou, Rostand and Anatole France produced plays that acquired wide popularity, and Renan and Taine wrote histories that were epoch-making in their methods. The literary future of France looked very bright during the early years of the twentieth century, but with the outbreak of the War of the Nations in 1914 there was practically a cessation of productions, excepting those of a controversial character.

A.MC C.



THE STORY OF THE FRENCH REVOLUTION

FRENCH REVOLUTION, one of the greatest internal struggles that ever rent any nation. The motto of its leaders was "Liberty, Equality, Fraternity" and if at the close it seemed that these had not been achieved (for the same reactionary Bourbon house again held the throne), the results were still very real and lasting. In the broadest sense the Revolution may be looked upon as extending from 1789 *to 1815,* the date of Napoleon's overthrow in the Battle of Waterloo, but this article treats only of the first ten years of that period, leaving the latter part to be considered in the article NAPOLEON I. The causes, too, are passed over here, but are fully discussed under FRANCE, subtitle *History.*

The Outbreak. Even Louis XVI, of the House of Bourbons who "forgot nothing and learned nothing," had become convinced that only the States-General, the legislative branch,

for more than a century and a half unsummoned, could deal with the critical questions that had arisen. In 1789, therefore, that body was called together and this very act was an acknowledgment that the sovereign of France was not absolute. But the States-General, before it could attack the waiting problems, had to settle its own method of voting. In the olden days the vote had been taken by classes, the nobles having one vote, the clergy one and the third estate, or commons, one, but it was evident to the third estate that if this plan were followed the two other orders could thwart every effort for reform. When the nobles and clergy refused to consider voting by poll the third estate withdrew and declared that they were the National Assembly, and that anyone who wished a voice in affairs must join himself to them. This the clergy did in large numbers, for many of them had sympathized with the lower classes in their downtrodden state, and gradually certain of the nobles added themselves to the number. This new Assembly, which was to meet as a single body, one man's vote counting for as much as any other, was known as the *Constituent Assembly*.

Measures of the Constituent Assembly. The task which this body had set for itself was the adoption of a constitution. Naturally enough, two tendencies showed themselves in it. Some members merely wanted reforms in government—regular meetings of the States-General and a lessening of taxation—but others wanted far more sweeping changes. The privileges of the nobles must be taken away, they demanded, and the king must admit the right of the people to a voice in the government; and as the demands of this latter class became more and more radical, the moderate element proved unable to restrain them. The Revolution thus was launched.

It happened that the Minister of Finance, Necker, was very popular with the people. When, in July, 1789, the king dismissed him, the people rose in open insurrection and stormed the Bastille, the great, gloomy prison which stood as the symbol of the tyranny of the upper classes. Necker was recalled, but it was too late for him to stem the tide. In order that riot might not go unchecked, the National Guard was organized; and many of the nobles, with the "great fear" upon them, left France, the first of the *émigrés*. Meanwhile, the Constituent Assembly declared all feudal rights and privileges abolished, and published flaming articles on the rights of man. In October, 1789, a mob, mostly women, rushed to Versailles, killed the royal guard and compelled the king and queen to return to Paris, whither the Constituent Assembly also removed. One of its popular acts at the time was the abolition of all titles of nobility.

In July, 1790, the new constitution was proclaimed and the king took oath to support it. The people distrusted him, however, and constantly suspected the exiled nobles of attempting to gain the aid of foreign powers against the Revolution, as indeed they were doing. Disregarding the advice of Mirabeau, the clearest headed man whom this first phase of the struggle produced, the king and queen tried, in June, 1791, to escape from France into Austria, but were captured and brought back, now more deeply under suspicion than ever before. A new constitution having been submitted to the king, the Constituent Assembly dissolved itself in September, 1791, and the Legislative Assembly took its place.

War Declared. Torn with dissensions within, France especially needed peace, that some stable form of government might be established, but in April, 1792, the Legislative Assembly hurried the country into war with Austria and Prussia. As always, lack of unity and discipline at home reacted on the army, and news of defeats drove the mob in Paris to frenzy. A band of rioters in August, 1792, broke into the Tuileries, put to death the king's guard and left Louis no alternative save to throw himself on the mercy of the Legislative Assembly. That body, still at the command of the mob, suspended him from his royal office and imprisoned him with his family in the Temple. Further news of defeat led to further mob violence, and in September, 1792, fewer than 1,000 royalists were slain in the prisons of Paris. On September 20, however, the tide turned. Victory in the Battle of Valmy fell to the French, and the Paris mob was for the time placated.

Republic Proclaimed; King Executed. On that same day, September 20, a new governing body, the National Convention, met, and for a time the military successes continued under its direction. So confident did the French become that they declared their intention of annexing Belgium and Savoy, and thus they made for themselves many enemies among the European powers. But an event soon occurred in France which stirred up still greater opposition among the outside nations. Not

content with declaring France a republic, the Convention in December, 1792, brought the unfortunate king to trial, and early in the next year he was beheaded. So while the nations of Europe were becoming more and more united against France, disunion was growing within the country. In the Convention two parties, the moderate Girondists and the radical Jacobins, contended for supremacy, the latter gaining step by step until by June, 1793, they were strong enough to expel the leaders of the Girondists and put them under arrest.

Reign of Terror. With the rise to power of the extreme Jacobins the Revolution entered upon its most terrible stage—the so-called Reign of Terror. The virtual dictators of the nation were the Committee of Public Safety, composed of the most radical members of the Convention, under the leadership of Danton (which see). It must not be assumed that this Committee performed its dreadful work merely because it was bloodthirsty; if France were to be saved from the aggression of outside nations, all wavering must cease, all theorists and mere orators must be removed from control of affairs, and death could secure the only safe and sure method of removal. Marie Antoinette, Philip Egalite, of the House of Orleans, Madame Roland—these were but a few of the hundreds upon hundreds of victims who were sent to the guillotine because they had aroused the suspicion of some member of the Committee. Actual guilt was not necessary, for the trials were but mock affairs. Paris became accustomed to the sound of the carts as they lumbered through the streets, carrying people, distinguished or insignificant, all their way to one common fate. Round about the guillotine gathered the terrible "knitting women" of whom Dickens tells in his *Tale of Two Cities*, who stopped in their counting of stitches only long enough to check up the heads as they fell.

Every phase of the Revolution had its leader, and the leader of this stage was Robespierre. If a man were too radical in his demands, as was Hébert, at the will of Robespierre he was sent to the guillotine, with his followers; if a man were not radical enough, and ventured to suggest that the Terror was passing all bounds, as Danton, he, too, was put out of the way. However, he who ruled by the Terror was perish by the Terror, and in July, 1794, a [illegible] against Robespierre succeeded and he [illegible] beheaded. With his death ended the Reign of Terror.

The Rise of Bonaparte. Now moderation came to the fore. The Girondists who had been expelled from the Convention were brought back, the Jacobin Club was closed, and in 1795 a new constitution, drawn up by the Convention, established a new government. This consisted of a Directory of five persons, and two legislative houses, the Council of Ancients and the Council of Five Hundred. However, Paris was not disposed to accept this constitution quietly, and in October a violent mob-outbreak occurred. With the quelling of this a young Corsican, Napoleon Bonaparte, had much to do, and from this time on he was one of the most prominent figures in France, gradually becoming the dominant man of the world.

During the latter part of the Convention government France's arms had been fortunate abroad, and under the Directory these successes bade fair to continue. Bonaparte won victories in Italy and other generals held back the Austrians, but conditions changed when Bonaparte went to Egypt. Then Austrian armies invaded Italy and several times defeated the French, while England and Russia renewed their aggressions. The Directory was no better able to cope with conditions at home. Financial affairs were hopelessly involved, and the general weakness of the government was all too apparent. A strong central government was what France needed, and wanted; and there was considerable talk of restoring the monarchy; but some of the wisest men of the time saw that there was another solution possible, and that the "Little Corsican" then absent in Egypt was the only man who could furnish it. At their invitation Bonaparte returned to Paris, overthrew the Directory and put himself at the head of affairs. For the next fifteen years the history of France was the history of Napoleon—all the threads of the Revolution had met in him. How he used his opportunity the article on NAPOLEON I makes clear.

A.MC C.

Consult Farmer's *Short History of the French Revolution*. A great novel which deals with the subject is Dickens' *Tale of Two Cities*.

Related Subjects. The Revolution and history of the period will be better understood by reference to the following articles.

Bastille	Mirabeau
Émigrés	Napoleon I
France, *History*	Robespierre
Girondists	Roland de la Platière
Jacobins	States-General
Louis XVI	Tuileries
Marie Antoinette	Versailles

FRENCH SOMALILAND, *so mah' le land,* a French possession at the entrance to the Red Sea, in Northeast Africa. It covers an area of about 5,790 square miles, and is therefore nearly as large as Rhode Island and Connecticut combined. The interior consists of a series of dry tablelands rising to a height of about 4,000 feet. The rivers, dry water courses late in the summer, become raging torrents for a short time during the rainy season in May and June. In some parts the soil is fertile and produces good crops of millet and other grains. Exports consist chiefly of coffee, hides, ivory, gum, mother-of-pearl and small quantities of gold. The most important industries are turtle and mother-of-pearl fisheries. There is only one good harbor, at Jibuti, the seat of government and terminus of a railway running through the colony into Abyssinia. Other towns of importance are Obok, the former capital, Ambado, and Tajurah.

FRENCH SOMALILAND

The colony is administered by a governor sent from France, and a council of six members. The inhabitants are of mixed nationalities, including Somalis, Indians, Arabs, Abyssinians and about 2,000 Europeans. In 1883, when there was considerable rivalry between France and England with regard to African possessions, the French annexed this colony. Treaties with England and Italy, whose colony of Eritrea forms part of the northern boundary, have clearly defined the limits of the French territory. Population in 1910, about 208,000.

FRENCHTOWN, Battle of. See Raisin River, Massacre of.

FRESCO, *fres' ko,* or **FRESCO PAINTING.** The term *fresco,* which is the Italian for *fresh,* is applied to a painting executed in water color on fresh plaster. Before beginning his work the artist usually makes a drawing of his subject in black and white, called a cartoon, which is exactly the size of the intended picture. A smaller-sized sketch is also prepared in colors, to use as a reference as the work proceeds. Enough fresh plaster for a day's work is laid on the surface to be decorated and the cartoon is then placed on the plaster, the outlines of the picture being traced in it by means of a dull-pointed instrument made of wood or bone.

The artist then proceeds with the painting, working as rapidly as possible. As fresco cannot be retouched successfully after the plaster is dry, a portion of the picture once commenced must be completed almost at once. When the day's work is ended, the artist removes any unpainted part of the plaster, cutting it neatly along the finished edge of the picture, so that the joining of the plaster for the next day's work may be concealed. The coloring in fresco painting is notably clear and pure, but it is lacking in richness and depth.

Fresco painting reached a high state of development in Italy in the fourteenth, fifteenth and sixteenth centuries. Among the most celebrated frescoes of that period are the

THE "ANNUNCIATION"
A fresco in the Convent of San Marco, Florence, executed by Giovanni Angelico.

decorations of the Sistine Chapel in the Vatican, by Michelangelo. His painting of *The Last Judgment,* which covers the entire altar wall, is the largest fresco in the world. Michelangelo also executed two large frescoes for the Pauline Chapel—*The Conversion of Saint Peter* and *The Crucifixion of Peter.* Several rooms of the Vatican are beautified by fresco paintings executed by Raphael, and the frescoes in the Church of San Marco, in Florence, by Fra Angelico, are also famous.

Fresco painting was revived in the nineteenth century by the German artist Peter von Cornelius, whose decorations in the Church of Ludwig, in Munich, are the most important frescoes of modern times. Through his influence the new Houses of Parliament, London, were decorated with this form of painting.

A special kind of fresco painting, called *fresco secco,* is employed in house decorations. In this process the colors are laid on the walls after the plaster is dry. Before the work is begun the dry plaster is rubbed with pumice stone for the purpose of removing the crust, and it is then washed with water mixed with a little lime. Such decorations have neither the permanence nor the delicacy of true frescoes. R.D.M.

FRESNO, *frez'no,* CAL., a prosperous grain and stock market, and the county seat of Fresno County, situated in the fertile San Joaquin Valley, in the central part of the state, 208 miles southeast of San Francisco. It is on the Southern Pacific and the Atchison, Topeka & Santa Fe railroads. In 1910 the population was 24,892; in 1916 it was 34,958, by Federal estimate. The area of the city is about five square miles.

Fresno is the shipping point for an important agricultural and stock-raising section. The principal exports include raisins, which are grown extensively, and raisin products, grapes, oranges, olives and other fruits, including Smyrna figs, and wheat, sheep and horses. Near the city is Kearney Park, an irrigated experimental farm owned by the University of California. Fresno is in a rich petroleum field and possesses several important industrial establishments. These include an oil refinery, fruit-packing plants, icing plants, a cooperage, planing and flour mills, a macaroni factory and fruit-drying establishments.

Among the more prominent public buildings are the Federal building, erected at a cost of $250,000, the courthouse, city hall and Carnegie Library. A short distance east of the city is King's River Cañon, southeast is the Sequoia National Park, and forty miles south is Tulare Lake. Fresno was settled in 1872, became the county seat two years later and received a city charter in 1885.

FREUD, *froit,* **AND FREUDIAN VIEWS.** See SUBCONSCIOUS.

FREY, *fray,* one of the most celebrated of the gods in Norse mythology, was the son of the sea god Njörd, and brother to Freyja, the goddess of love. He presided over the rain and sunshine as well as all the fruits of the earth. At sacrificial feasts the Norsemen and their guests filled their horns and prayed to him for a prosperous season and for peace.

Frey was an especial favorite of the other gods, who presented him with gifts which figure prominently in Norse mythology, among them a magic sword which would fight by itself the moment it was drawn from its scabbard; a ship which, while large enough to carry all of the gods and their attendants, at will could be folded up and tucked into a pocket; and a boar with golden bristles, which enabled Frey to ride over land and sea with incredible swiftness. Frey fell in love with Gerda, the daughter of the giant Gymer, and in order to gain the assistance of his servant in winning the lovely maiden for his bride, Frey was obliged to part with his wonderful sword, which was afterward greatly needed by the gods in all their combats. Frey was worshiped extensively throughout the Northern countries; in fact, in some provinces of Sweden the people at an early day put their highest trust in him and even believed that at times he appeared in human form.

FREYJA, *fra'yah,* in Norse mythology, the goddess of love and beauty, and the sister of Frey (which see). Although she corresponds to Venus of Greek mythology, the conception of her differs somewhat, as Freyja is regarded to some extent as a war goddess, and often accompanied the valkyries when they flew down to the battlefields to carry away the slain warriors (see VALKYRIE). She always asserted her right to one-half of the slain, the other half belonging to Odin, the god who represented the spirit of life. The warriors afterwards were carried to her palace and there entertained sumptuously.

Freyja married a god named Oder, who deserted her in order to travel into remote countries; from the day of her desertion she wept continuously, and her tears were drops of gold. She is, therefore, called the fair, weeping goddess. In Norse poetry, gold is called "Freyja's tears" and "the rain of Freyja's brows or cheeks." Freyja's cats, which drew the chariot wherein she traveled in quest of her husband, symbolize sly fondling and sensual enjoyment. The name of her husband, Oder, signifies wild desire. The diversified names bestowed upon Freyja in her journeyings to the various countries visited denote the various modes by which love reveals itself in human life.

FRI'AR, a general name applied to a member of a comparatively recent religious Order to distinguish him from a member of an older community of *monks.* The latter title applies especially to the Benedictines and their branches, and is incorrectly applied to the mendicant Orders. The founders of the Do-

minicans and Franciscans, inspired by humility, designated their followers by the simple title of *brother*. Saint Francis called his disciples *friars minor,* or lesser brothers, while Saint Dominic termed his Order the *preaching friars*. The popular English names of these Orders, derived from the distinguishing characteristics of their habits, are preserved to the present time in the names of English streets and localities. Examples of these are *gray friars* (Franciscans), *black friars* (Dominicans), *white friars* (Carmelites), *Austin friars* (Augustinians), etc. See MONK; MONASTICISM.

FRICTION, *frik'shun,* a word derived from the Latin *fricare,* meaning *to rub,* is applied in physics to the resistance which one body offers to another when dragged or pushed across its surface. If two objects with flat surfaces are placed one on top of the other so that their surfaces are in close contact the topmost object may be lifted without resistance except that of gravity. If, however, an attempt is made to push the topmost object along the surface of the other, friction occurs.

Friction is greater between rough than between smooth surfaces. It is friction that makes the wheels of a locomotive grip the rails of the track; it causes an endless belt to turn the wheels over which it is placed. Without friction few motions would be possible, and trains would have to be run by machinery consisting chiefly of cogwheels. Unevenness of surfaces causes friction and loss and energy in machinery, and leads to the use of oil to fill the spaces so that the surfaces will move upon each other the more readily.

FRI'DAY, the sixth day of the week, derived from the German word *freitag,* which means *day of Freya.* Freya, or Freyja, who was the goddess of love in Norse mythology, was driven in a beautiful chariot, drawn by cats, and liked music, spring and flowers. One thing known concerning the very ancient Scandinavians is that they considered Friday their "luckiest" day, but, since the crucifixion of Christ on that day, many people regard it with superstitious dread. In the Roman Catholic, Anglican and Greek churches, Fridays, except when they fall on Christmas, are observed as days of fast in memory of the crucifixion, while the Friday before Easter, called Good Friday, is observed quite generally among Christians as the day of the Passion. Among the Mohammedans it is the day for religious gatherings, chosen as the day on which Adam was created and as the day of Resurrection. From its association with the crucifixion, it is considered the proper day to set for the execution of criminals and as such is sometimes called hangman's day. See FREYJA.

FRIEND'LY ISLANDS, the name given by Captain Cook, the discoverer, to the Tonga Islands (which see).

FRIENDS, SOCIETY OF. See QUAKERS.

FRIG'ATE, a former type of war vessel which was larger than a sloop and smaller than a battleship. The term was first applied to fast-sailing merchant vessels which were hired in the sixteenth century for service with the

A FRIGATE

A type of the most popular style of vessel prior to the period of the War of Secession.

English navy. The first frigate built as a war vessel was the *Constant Warwick* which, in 1677, became part of the navy and carried forty-two guns. In the eighteenth century frigates were regarded as the best type of fighting ships. The English vessels had a tonnage of from 500 to 1,200, while some of those built for the United States navy were larger. Frigates carried three masts and were known as "full-rigged ships." The most famous frigate of the United States navy was the *Constitution,* launched October 21, 1797 (see CONSTITUTION). The introduction of ironclad vessels caused the building of frigates to be completely abandoned. "Cruisers" now occupy the position in the navy formerly taken by frigates. See WARSHIP.

FRIGATE BIRD, or **MAN-OF-WAR BIRD,** a bird of prey, which, on account of its immense extent of wing and its dashing habits,

has been called the swiftest bird that sweeps the seas. *Man-of-war bird* is the older name for the *Fregata,* but it is less distinguishing, some of the large albatrosses being so called

THE FRIGATE BIRD

(see ALBATROSS). The frigate bird is a tropical sea-bird of two species; the larger ranges all round the world within the tropics; the smaller is found only near the Eastern seas from Madagascar to Moluccas and southward to Australia. Both species breed in large colonies, and build their nests on rocks, high cliffs or lofty trees on uninhabited islands. The upper plumage is dark brown, with a metallic gloss; the females have pink feet; the males, black. The male acquires under its bill a bright scarlet pouch which is capable of inflation.

FRIGGA, *frig'gah,* or **FRIGG,** a goddess in Norse mythology, the wife of the god Odin, who represented the spirit of life and permeated the whole universe. In some respects Frigga corresponds to Juno, in classical mythology. She was also known to other Teutonic peoples, both on the Continent and in England, where her name still survives in the word Friday. Very often she is wrongly identified with Freyja, who might be compared more fitly with Venus. Frigga typifies a mother's love; Freyja, the love of youth. Frigga knows the fate of all men, but she neither says nor prophesies anything about it herself. See ODIN; FREYJA.

FRINGE TREE, a slender, narrow-topped tree, twenty to thirty feet high, which blossoms in May and June and produces delicately fragrant, fringelike flowers of dainty beauty. It is found from Southern Pennsylvania to Florida and west to Arkansas and Texas. In Southern Europe it is highly prized as a beautiful exotic (not native) specimen from America. A species found in China has flowers with shorter, broader petals, but in grace and beauty it cannot compare with the American variety.

FRO'BISHER, SIR MARTIN (1535-1594), the first English navigator to search for a northwest passage to India. He was a friend and companion of Drake and Hawkins, and one of the greatest seamen of the days of Queen Elizabeth. Frobisher made three unsuccessful attempts to reach India by sailing westward, but proceeded little farther than the south of Greenland. He later conducted many expeditions against Spain, and was knighted for his services against the great Armada in 1588 (see ARMADA). After raiding many towns on the Spanish coast, he died from the effects of a wound received while attacking Brest.

FROEBEL *freb'el,* FRIEDRICH WILHELM AUGUST (1782-1852), a German educator and child-lover, the founder of the kindergarten (which see). In Thuringia, where he was born, the name *Froebel* is to be seen carved in huge letters in the cliffs of a mountain pass; and just as deeply is his name engraved on much that is best in modern education. This man who did so much to make other children happy had himself a childhood that was far from happy. Not long after he was born, on April 21, 1782, at Oberweissbach in Thuringia, his mother died, and his father, a Lutheran pastor, neglected him sadly. The stepmother who came to preside over the home when the child was four years of age proved the typical stepmother of the fairy tales, and her harshness caused the quiet, dreamy child to withdraw more and more into himself. In after years it was probably the memory of what he wished for in those early days that gave him so true an understanding of the child heart.

FRIEDRICH FROEBEL

When he was ten he went to live with an uncle and in his school life was fairly happy, though the teachers never understood him and considered him little better than a dunce.

Apprenticed in 1797 to a forester, he roamed the Thuringian woods, acquiring a knowledge of nature that tinged all his life work. Later he studied architecture, and only on the insistence of a schoolmaster friend did he turn his attention to teaching. At once he showed his wonderful fitness for the work, but even his association with Pestalozzi, whom he frequently visited, did not convince him that he had really found his life work. In 1813 he was drawn into the wars with Napoleon, which were engaging all Europe, and saw active service against the French. By the time the struggle was over he had become convinced that education was the one subject vital enough to claim all his energy.

In 1816, two years before his marriage, he founded at Griesheim a school to which he gave the sounding title of Universal German Educational Institute. Through the next twenty years, though he taught steadily and conscientiously, he was far from satisfied with his progress, feeling that the method was wrong from the start; but in 1836 he hit upon what he called a "definite truth"—an inspiration which led to the founding of the first kindergarten. [A name puzzled him for some time, but when *kindergarten* flashed across his mind it fully satisfied him.] His first kindergarten (child garden) was opened at Blankenburg, and after 1850 he lived and worked at Marienthal, where he died on June 21, 1852. It seems strange that in his own day he encountered fierce opposition, and that in 1851 a law was passed in Prussia forbidding the founding of kindergartens. From his own point of view his life work must have seemed a failure, but the best estimate of succeeding times is given in the vast number of kindergartens which exist in every civilized country. Educators do not hesitate to declare that the kindergarten was among the greatest educational developments of the nineteenth century, and that Froebel was one of the greatest educators.

The chief principles of Froebel's educational creed, briefly stated, were that the education of a child should begin at its birth; that it should be conducted by the natural method—by the developing of impulses that come from within the child; that the most can be accomplished if the child is kept happy in his work and allowed to follow the lines of his own interests; and that training should be threefold, touching the physical, mental and spiritual sides of the child's nature. See KINDERGARTEN.

The following books will be found helpful to those who wish to study Froebel's life and work in more detail: His *Autobiography;* Blow's *Letters to a Mother on the Philosophy of Froebel;* Bowen's *Memoir* in the *Great Educators Series;* Hanschmann's *Life of Froebel;* White's *Educational Ideals of Froebel.*

FROG, a little, cold-blooded, tailless animal common in all parts of the world except Australia, though rare in South America. The chorus of frogs and their relatives, the toads (see TOAD), starts soon after the ice of ponds

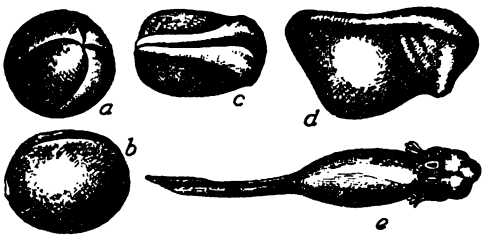
"When by night the frogs are croaking, kindle but a torch's fire;
Ha! how soon they all are silent!"

begins to thaw and when pussy-willows are gray. It lasts throughout the summer and until once again cool weather heralds the approach of winter's ice and cold.

Among the hundreds of nature's wonders in the vegetable and animal life in swampy places and along the shores of lakes and streams, the life of a frog is one of the most interesting. In early spring, the mother frog lays masses of tiny eggs, velvety black above, creamy white beneath. So small are they that a mass of five or six thousand would measure only about five inches in diameter and two and a half inches thick. About the eggs a jellylike substance is secreted, and then away on the waters they float and within a few hours begin to develop.

After wonderful growth and change, within nine days the tiny black specks have changed into queer little water animals, called tadpoles, or pollywogs. They are not at all like the parent frogs. They have neither mouths nor limbs, but have branching gills and long tails with which they swim. Their bodies look like roundish lumps of dark jelly. Soon the mouth develops, gills disappear and finally hind legs begin to grow. Then come front legs and teeth and lungs, and the animals rise to the surface to breathe. The tails then drop away, and at last, within two or three months, there is a family of smooth-skinned frogs, keen of sight and hearing, fine swimmers and wonderful jumpers.

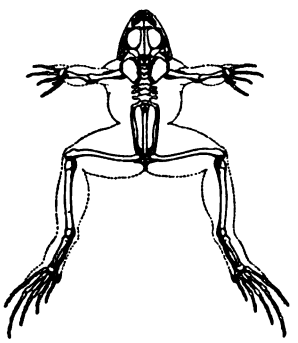
A frog does not attain full growth for three or four years, however, and it is supposed to live ten or fifteen years. Tadpoles live chiefly on vegetable matter, but grown frogs live on insects, slugs, snails, etc. Most frogs live on



FIRST STEPS IN DEVELOPMENT

(*a*) Egg, drawn to show first two vertical grooves corresponding to two partitions which divide the egg into four cells. (*b*) Afternoon of third day; egg as seen from right side. (*c*) Next day; folds are closing in over grooves, to form the nerve tube. The front of this tube will form the brain, and the remainder will be the spinal cord. (*d*) Afternoon of fifth day; embryo in same position as *b* and *c*, though more fully developed. (*e*) Tadpole just hatched.

both land and water and are therefore amphibious. The tree-frog lives almost wholly on land. Like toads, frogs frequently change their skins, and they eat their old suit of clothing while pulling it off over their heads. They also change color, somewhat to match their surroundings, from the green of lily pads to a duller shade nearer the brown of fallen leaves. Toads differ from frogs in having no teeth, being broader, flatter and darker, and in having larger eyes and a warty, more poisonous skin. The best known frog in America is the bullfrog; other species are the green spring-frog, the leopard-frog, the wood-frog and the edible frog.



SKELETON

Frogs are not only relished by fish and birds, but man, both civilized and savage, in addition to using them as bait in fishing, regards them as choice food. In France they are so highly-prized they are bred for the market in large quantities. In America both the bullfrog and the spring-frog are sold. Only the hind legs are eaten in America and in France, and they are usually fried. In Germany all muscular parts

V.L.K.

FROHMAN, *fro'man,* CHARLES (1860-1915) and DANIEL (1853-), theatrical managers, members of the theatrical syndicate organized in New York in 1895. Both brothers were born in Sandusky, Ohio. The elder, Daniel, began his business career in a newspaper office, where he worked for five years. Subsequently he became manager of a traveling theatrical company, and since then has managed many New York theaters and theatrical companies, including the Lyceum Theater, Daly's and the Daniel Frohman Stock Company.

Charles Frohman has been called the "theatrical Napoleon" of America. Although given little early education and ignorant of the theory of dramatic art, he instructed many accomplished actors in the proper methods of reading their lines. He advanced Maude Adams to the place which she holds to-day, and was instrumental in bringing forward a great many well-known American actors. After managing several road companies he obtained control of the Criterion, the Museum, the Garrick, the Savoy, the Madison Square, the Knickerbocker, and the Garden Theater in New York City, besides the Duke of York Theater in London. In 1895 he organized the syndicate of which he was the head. During one typical season he put on twenty-five stage productions, employed 795 actors, and paid out salaries amounting to over $25,000 a week. Up to the close of the season of 1912 he had produced more than 600 plays.

He lost his life in the *Lusitania* disaster, on May 7, 1915. His last known words, spoken on the deck of the sinking ship, have become famous: "Why fear death? It is the most beautiful adventure that life gives us!"

FROISSART, *frwah sahr',* or *froi'sart,* SIR JEAN (about 1338-1410?), a courtly poet and historian of the time of Edward III. As one editor remarked, "Froissart's whole business was to live in the fourteenth century, and tell us what he saw there." His name stands for chivalrous adventure in the minds of all readers of history. His most famous work is the *Chronicles,* four volumes of vigorous, picturesque tales of the wars and other events of his century. In the poem *L'Espinette Amoureuse* he has given an account of his school days and early love affairs. He studied for the ministry, but his inclinations were always toward writing stories and poems of chivalry and adventure. In 1361 he went to England to present one of his books to Queen Philippa, and spent five years in the English Court as sec-

retary to the queen. He was at Bordeaux on Twelfth Night, 1367, when Richard, the son of the Black Prince, was born; and he was bidden to write down the fact for his book of *Chronicles*. When Queen Philippa died in 1369, Froissart went back to his own country of Hainault, where he worked diligently on his *Chronicles*. Not much is known of the last years of his life, and the date of his death is uncertain.

FRONDE, *froNd,* a French word meaning *sling,* the name given to the period of civil strife in France during the minority of Louis XIV, from 1648 to 1653, and also applied to the aggressive faction concerned in that struggle. The conflict was called the "War of the Fronde," or of the "Slingers," a contemptuous reference to the common use of the sling among the urchins of Paris. The movement originated with the opposition of the Parliament of Paris to the tyrannous measures of Mazarin, the Prime Minister (see MAZARIN). In the insurrection which followed, the forces of the Parliament were overruled by the Prince of Condé, acting for the court party. Later Condé quarreled with Mazarin, who arrested him. This action aroused the nobles and led to the Prime Minister's exile. Soon after when Louis XIV came of age, he recalled Mazarin and placed Turenne at the head of the army. Condé was defeated near Paris in 1652, which conquest led to the final victory of the court party and of Mazarin.

FRONTENAC, *froN te nak',* COMTE LOUIS (1620-1698), an able, energetic, farseeing governor of New France, the name applied to the early French possessions in North America. He, together with Champlain and LaSalle, formed the trio which established the French power in America. It was Frontenac, more than any other man, who placed it on such a firm basis that it survived his death for three-fourths of a century.

When Frontenac was appointed governor of New France in 1672 he was already in middle life. As a mere boy he had become a soldier, at twenty-three he was a colonel, and at twenty-six he was a brigadier-general. He saw active service in Flanders, Germany and Italy. His military habits, his occasional arbitrary commands and his frequent outbursts of temper involved him in difficulties with the civil authorities of the province in America after he became governor. He was tactful and masterful by turns in his dealings with the Indians, and the colony as a whole prospered under his rule. He encouraged exploration of the West, and his aid stimulated LaSalle, Joliet and Marquette. Meanwhile he quarreled incessantly with the *intendant,* or treasurer, of the province, and with the priests, until finally, in 1682, he was recalled to France.

An interval of only seven years was enough to prove that New France needed Frontenac's iron rule, and in 1689 Louis XIV reappointed him as governor. It was the ultimate aim of the French to drive the English out of North America, or at least to restrict them to a narrow strip along the Atlantic Ocean. Frontenac at once began vigorous campaigns against the Iroquois, who were being encouraged and aided in their attacks on New France by the English. The New York and New England frontier became the scene of a cruel warfare. Frontenac's bands of French and Algonquins burned and plundered, but were unable to make permanent conquests. In 1690 Frontenac defended Quebec against an English fleet, and in 1696 he finally compelled the Iroquois Indians to sue for peace. The Treaty of Ryswik (1697), which put a temporary stop to the war, was followed in less than a year by the death of Frontenac.

FROST, a beautiful formation of ice which bestows on bare and unsightly trees magic garments of sparkling crystal, and traces on the windowpane patterns as lovely as the most delicate filigree work. The work of "Jack Frost" is described in an old-fashioned poem that many a child has memorized:

He went to the windows of those who slept,
And over the pane like a fairy crept;
Wherever he breathed, wherever he stepped,
By the light of the Moon were seen
Most beautiful things; there were flowers and trees,
There were bevies of birds, and swarms of bees,
There were cities with temples and towers, and these
All pictured in silver sheen.

Frost is the moisture always found in the air, condensed on vegetation and other objects when the temperature falls below the freezing point, 32° F. During the daytime the earth absorbs much heat from the sun's rays; this heat it gives up again as soon as the sun sets. On the rapidly-cooling surface of the earth, the moisture in the atmosphere is chilled and condensed, but so long as the temperature remains above 32° F., dew is formed instead of frost. Thus, dew may be said to correspond to rain and frost to snow. Practically it may be said that frost is frozen dew. The frost for-

mation on a window pane occurs when the air out-of-doors is below 32°, the moisture being deposited on the glass in the form of tiny prisms of ice.

When the sky is cloudy at night the ground cools less quickly than on clear nights, and for that reason frost and dew are less plenti-

These winter nights against my window pane
Nature with busy pencil draws designs
Of ferns and blossoms and fine spray of pines,
Oak leaf and acorn and fantastic vines
Which she will make when summer comes again.
—T. B. ALDRICH: *Frost-Work.*

At left, in illustration: branching hoar frost. At right: crystalline window frost.

ful after a cloudy night. In the growing season farmers and fruit-growers watch the sky closely on chilly evenings. A cloudless sky is often a cause for anxiety, because frost is destructive to growing things. This is due to the fact that the juice of the plants, which is largely water, swells on freezing and bursts the delicate cells. Because of the damage done by late spring and early fall frosts, the subject of protection from frost has been made a matter of special study by the United States Weather Bureau, and the results are summarized in a bulletin entitled *On Frost Protection.* See DEW. C.R.M.

FROST'BITE, a term applied to the effect of extreme cold on some part of the body. Mild cases are known as *chilblains,* and these occur usually on the hands and feet. The parts affected have a purplish-red color and are somewhat swollen, attended at times with itching and pain. Chilblains appear in the spring and fall, or in winter during damp weather. When first frozen the treatment consists of rubbing the frost-bitten parts with snow or ice, in order to restore slowly the natural warmth and avoid a violent reaction which might cause disease of the bone and soft tissues. In extremely severe cases of freez- [redacted] the affected parts may decay and drop [redacted] spread of the trouble is not promptly [redacted] may develop and delirium

See GANGRENE.

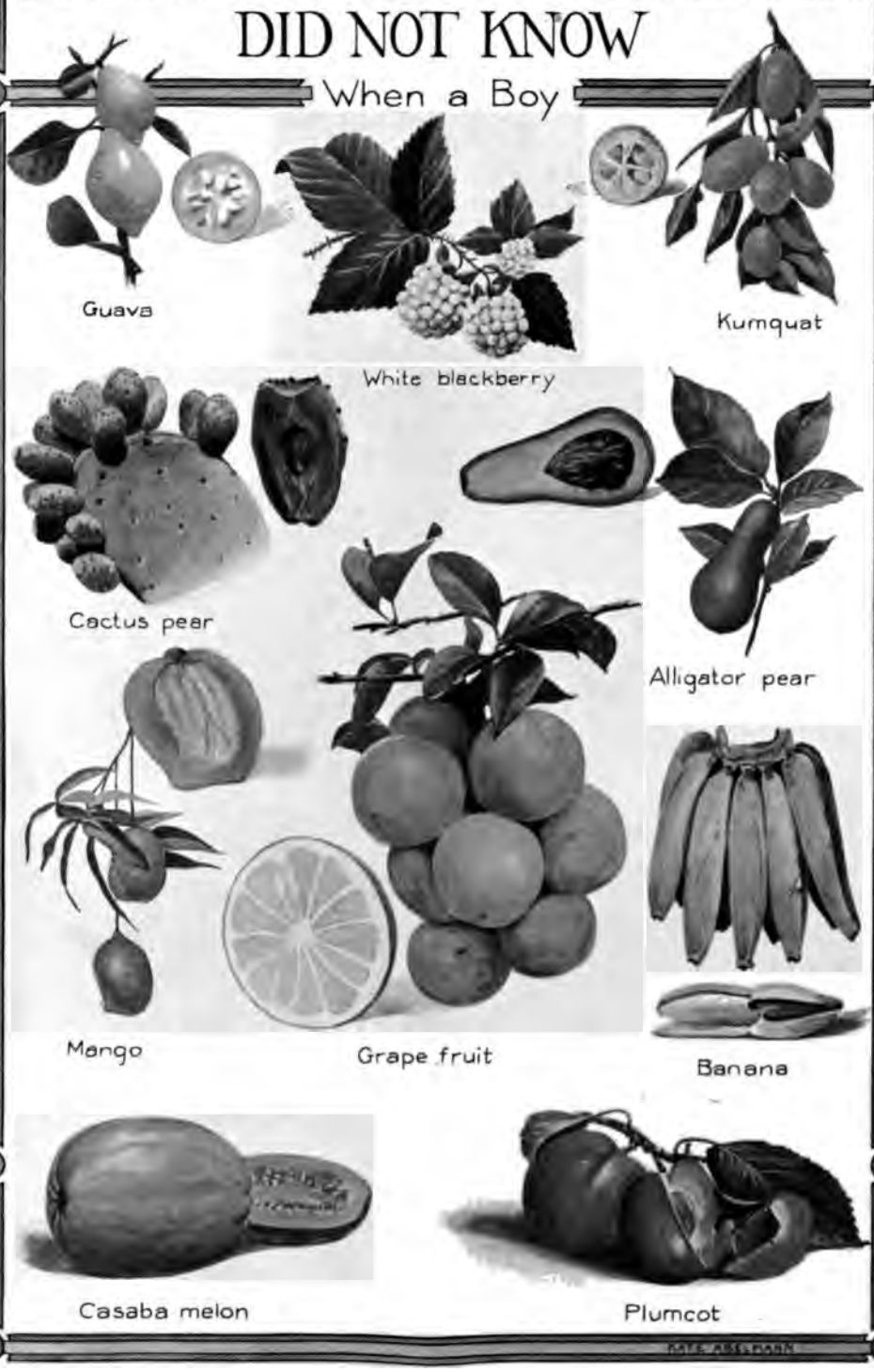
FROUDE, *frood,* JAMES ANTHONY (1818-1894), an English historian, of whom it is said that he was more a man of letters than an historian, as he was prone to distort facts. This tendency to misstate was not a conscious one, perhaps, but he selected certain details and suppressed others for the sake of making his heroes appear brighter and his villains darker. The first two volumes of his *History of England* appeared in 1856, and attracted a great deal of attention on account of the author's brilliant style and the boldness of his opinions. After his visit to the United States in 1872 on a lecture tour he published his lectures under the title *English Misrule in Ireland.* He was the friend of Carlyle, whose literary executor he became. After Carlyle's death Froude published *The Reminiscences of Carlyle, Letters and Memorials of Jane Carlyle,* and *Thomas Carlyle: a History.* In 1892 Froude succeeded the historian Freeman as regius professor of history at Oxford. His lectures were afterwards published in a volume entitled *Erasmus.* Among Froude's other works are *The English in Ireland in the Eighteenth Century* and *Life of Lord Beaconsfield.*

FRUIT, *frute,* a word which in botany refers to the seed of a plant and its covering. The fruit appears in widely different forms, as the pods of peas or nuts of trees, or tomatoes or apples. In a general and more popular sense, however, the name refers only to such edible products of certain plants as are used for food as desserts, in the raw, dried or cooked state. The apple, pear, peach, plum, cherry, orange, lemon, date and fig are among the most familiar fruits in America.

The cultivation of fruits is one of the most important industries. North America ranks first in quantity and variety produced, and in the use of scientific methods of production. The American states east of the Rocky Mountains are supplied with grapes and raisins, citrous fruits, fresh and canned peaches, pears, cherries and apricots by the fruit-growers of California. Canada receives a portion of the crop, as its yearly fruit production of $13,000,000 worth seldom meets the demand. During the winter months Northern markets are furnished with strawberries, peaches and other fruits grown in the states along the Gulf of Mexico. Fresh apples, lemons, bananas and oranges may now be purchased the year round, and pears, strawberries, grapes and peaches have much longer seasons than formerly. Fruits play an important part in international

FRUITS THAT GRANDFATHER DID NOT KNOW

When a Boy



THE UNIVERSITY OF MICHIGAN LIBRARIES

In 1914 the United States exported
lued at over $31,000,000, and imported
34,000,000 worth.

Value of Fruits. Fresh fruits do not
h meats and cereals in actual nutri-
ie, but they constitute a desirable por-
the diet for other reasons. Certain
d salts found in them are believed to
beneficial effect on the system, and
h water content, in some cases four-
the whole, makes them of value as
. Moreover, they are among the
ractive of all foods, both in appearance
taste, and the pleasure derived from
g of them has a happy effect on the
and the digestion. Decaying and un-
its should always be avoided, and it
nwise to overindulge in those at the
stage of maturity. As a rule, fresh
aten in moderation are thoroughly
ed.

ydrates, including sugars, starches and
vegetable jelly), constitute the most
t nutritive material in fresh fruits.
fat and ash, the latter the source of
acids and salts, are found in small
ns. In proportion to their bulk, dried
rated fruits contain much more nutri-
terial than do fresh fruits. The car-
e content is also increased when fruits
ed or preserved. S.L.A.

d Subjects. The following articles in
lumes will give an idea of the many
of fruits which are of commercial im-
:

Pear	Lemon
	Loganberry
	Loquat
	Melon
t	Mulberry
ry	Muskmelon
it	Nectarine
felon	Orange
'	Pawpaw
	Peach
	Pear
ple	Persimmon
y	Pineapple
	Plum
	Pomegranate
ry	Prune
	Quince
it	Raspberry
	Strawberry
rry	Tangerine
	Watermelon

o, the following general articles relating
bject:

l Girls' Clubs	Food Products,
Clubs	Preservation of

FU-CHOW, or FOO-CHOW, in Southeastern China, one of its five treaty ports, thrown open to foreign commerce in 1843. It is an ancient walled city, capital of the province of Fukien, on the Min River, thirty miles from its mouth. The river is crowded with junks and boats, many of which are used as dwellings. The walls of the city are six and one-half miles in circumference and twenty-five feet high, with seven gates guarded by high watchtowers. Fu-chow is sometimes called the "Banyan City" on account of the great number of banyan trees in its gardens and squares (see BANYAN).

The River Min is here partly crossed by a stone bridge, 1,350 feet long, called the "Bridge of Ten Thousand Ages," leading to a densely-populated island which is connected with the opposite shore by a second bridge 300 feet in length. Below this bridge ocean-going vessels load and unload their cargoes. Here also is the most important naval arsenal in the entire country. The chief exports are tin, timber, cotton goods, matches and fruits. Among the principal imports is opium, forced into the Chinese market by the treaty of 1843. The import of this hurtful drug is diminishing under the stringent regulations adopted by the government. Population, about 624,000.

FUCHSIA, *fu'shi a,* a beautiful house and garden plant, popular in America and Europe. There are about seventy species, most of which are natives of tropical America. Some are merely shrubby plants, some are small trees and others are climbers. With their gracefully-drooping, funnel-shaped flowers, usually white within and pink, red or purple without, and pistils and stamens dangling, the name of *ladies' eardrops,* sometimes given them, is very appropriate. From the name of their discoverer, Leonard Fuchs, a German botanist, the name was derived.

FUCHSIA BLOSSOMS

Fuchsias are most easily grown from cuttings. They demand a light, porous soil, plenty

er and protection from strong sun- If planted in the spring in a partially- place a fuchsia cutting will develop by) a fine plant. Some species make very tory indoor winter plants, and will put ovely blossoms for many months if ell watered and out of the direct rays sun.

:L, the name given to numerous sub- from which heat is obtained by burn- combustion. When fire was first used ı is not known, but however far back listant past it may have been, the ques- obtaining materials to feed fires has ıce been one of great importance. When overran the land a supply was always le, but as the value of wood for build- poses constantly increased it was neces- seek other substances. Coal, which has the standard fuel by which all other re measured, was known to the Greeks t 300 years before the Christian Era. esses the advantage of furnishing great ut has the disadvantage of being heavy. solid fuels include coke, charcoal, peat, icks made from coal dust and tar or dhesive substance. Liquid fuels include um and its products, alcohol and many of vegetable and animal oils. The chief or heating are coal gas and natural gas.

Values. Calculations based on ex- e show that the relative value of coal od is 2½ to 1; that is, two and one-half of wood must be burned to produce me amount of heat as would be ob- from one pound of anthracite coal. ve nearly double the heat value of coal, e also less injurious to engines and fur- in which they are used. Oil fires may tantly started or extinguished; the oil es little smoke and leaves no refuse. e other hand, there may be danger of on, and there is always some loss of oil poration. Three and three-quarter bar- crude petroleum, each containing forty- llons weighing six and one-half pounds llon, have a fuel value equal to one ton l. The use of gasoline is increasing so that it is evident that the number of s operated by that fuel will rapidly in-

s. Natural gas is an ideal fuel, with er cent greater heat value than coal gas. be obtained only in a few locations, er, so its utility is not widespread. For tic purposes, coal gas has many advan- tages. It prevents waste, as it need only be burned while its heat or light is actually needed, and can be easily extinguished or lighted. To the consumer the gas costs from seventy-five cents to one dollar and fifty cents per 1,000 feet. The heat value of 1,000 feet of gas is equal to fifty-nine pounds of anthra- cite coal.

Charcoal is extensively used in chemistry, industrial arts and for melting metals. It burns quickly and leaves little ash. Coke produces violent heat and possesses qualities very similar to those of charcoal. Peat is a low grade fuel that is used extensively for domestic purposes, especially in Ireland, where the greatest peat bogs abound.

Related Subjects. The reader is referred to the following articles in these volumes:

Charcoal	Gas
Coal	Gasoline
Coke	Peat
Forests and Forestry	Petroleum

FUGITIVE SLAVE LAWS, statutes passed during the slavery controversy in the United States, providing for the return to their mas- ters of runaway slaves escaping from one state to another. In the Ordinance of 1787 (which see) a clause provided for the return of slaves who had escaped to the free territory of the Northwest. The first fugitive slave law, passed in 1793, allowed an owner upon the presenta- tion of an affidavit to secure the arrest and return of a slave who had escaped to free soil. The runaway slave had no right to trial by jury or to give any evidence in his own behalf. Some of the Northern states, opposed to the operations of this law, passed personal liberty laws forbidding state officers to aid in the re- covery of fugitives. In 1850 another fugitive slave statute was passed, inflicting heavy pen- alties for refusal to aid in the capture of run- away slaves. The owner's oath was made suf- ficient evidence for the slave's return. This law increased the sentiment against slavery throughout the North. The opposition to the law reached its climax in the North at the time of the publication of *Uncle Tom's Cabin* by Harriet Beecher Stowe, and hastened the war between the two sections (see WAR OF SECESSION).

FUJIYAMA, *joo je yah' mah,* **FUJI-NO-YAMA,** or **FUJI-SAN,** the beautiful sacred mountain of Japan, rising 12,395 feet above the sea, sixty miles west of Tokyo. Each sum- mer thousands of pilgrims from all parts of the empire climb by one of the five paths to

its summit, or worship at the shrines and temples along the way. Moreover, it is one of the most interesting objects in all Japan for tourists. Through Japanese legend and art, as shown on many objects, from beautiful

FUJIYAMA

screens to dainty fans or teacups, all nations of the world have come to know this perfect cone-shaped "Matchless Mountain," with its snow-capped peak caressed by clouds. That it was once a flaming volcano is now almost forgotten, for the last eruption from its 500-foot crater took place in 1707.

FULGURITE, *ful'gu rite,* a term derived from the Latin word *fulgur,* which means *lightning,* and has been modernly applied to an explosive. Technically, fulgurite is a rocky substance, formed into a sort of impure glass by fusion caused by a stroke of lightning. It is therefore somewhat rare, and assumes the form of a vertical tube. Sometimes these tubes run for several feet downward in the sand, but they are rarely found in hard or compact rock. The tubes have the appearance of opaque glass. Particles of minerals like mica and feldspar are more easily melted than materials which are composed largely of quartz.

FULLER, MARGARET. See OSSOLI, SARAH MARGARET FULLER.

FULLER, MELVILLE WESTON (1833-1910), Chief Justice of the United States Supreme Court for twenty-two years. On Monday, April 30, 1888, he was nominated by President Cleveland to fill the vacancy occasioned by the death of Chief Justice MORRISON R. Waite. President Cleveland said that a Chief Justice was needed who would be a man of efficiency as a business manager, and within a year, under Fuller's direction, the old-time delays in the business of the Court began to be remedied. He systematized the work so as to eliminate the law's delays as far as possible, thus proving that the right man had been chosen.

MELVILLE W. FULLER
For twenty-two years Chief Justice of the Supreme Court of the United States, the highest judicial post in the world.

He was a graduate of Bowdoin College at the age of twenty, studied law at Harvard, and was admitted to the bar in Augusta, Me., in 1855. In 1856 he moved to Chicago, where he practiced law for thirty-two years. He became a member of the Illinois constitutional convention in 1862, the following year was elected to the state legislature, and four times was a delegate to the Democratic National Convention for the nomination of the Presidential candidates. He withdrew from active politics in 1880. He was one of the arbitrators of the Anglo-Venezuelan controversy in 1899.

FULLER'S EARTH, a variety of clay sometimes used for cleaning cloth that has been soiled by grease or oil. It is in the form of a fine powder which is very porous; when applied to cloth the earth absorbs the grease. Fuller's earth was formerly used in factories for scouring woolen fabrics, but other methods have replaced it. It is composed of alumina, silica, magnesia and lime, and feels like powdered soap.

FUL'MAR, a name applied to any of several species of oceanic petrels. The common northern fulmar is about the size of a duck. It abounds in most northern seas, and breeds on the rocky shores of the Faroe Islands, Iceland, Greenland, Spitzbergen, etc., making an excavation in high, rocky places for its nest, in which it lays one egg. It is rarely found on the United States coast south of Massachusetts, or on the southern coasts of Great Britain, but is most in evidence on Saint Kilda, in the Outer Hebrides, Scotland, and neighboring isles. Its flesh and eggs are highly prized by the inhabitants of Saint Kilda. The bird is also valued for its feathers, down and oil. It feeds on any animal substance, with a preference for whale blubber. See PETREL.

A FULMAR

FULMINA'TION, in chemistry, a word describing an explosion of certain compounds by percussion or heat. *Fulminates,* or explosive compounds consisting of fulminic acid and mercury, gold, silver or platinum, are used as priming in percussion caps to cause the explosion of gunpowder in cartridges and shells. Fulminate of mercury, most commonly used, is obtained by dissolving mercury in nitric acid and then adding alcohol to the solution. The fulminating, or explosive, mercury is deposited in crystals; the process is attended with danger, as when dry the crystals explode if struck even lightly by any hard substance.

FUL'TON, N. Y., a center for the cheese trade of the northern part of the state, is situated in Oswego County, on the east bank of the Oswego River and on the Oswego Canal, a branch of the New York State Barge Canal (which see). The city of Oswego is twelve miles northwest and Syracuse is twenty-six miles southeast. The New York, Ontario & Western, the New York Central and the Delaware, Lackawanna & Western railways serve the city. Electric lines connect with points north and south, and water transportation is had with Lake Ontario through the canal. In 1791 the first settlement was made, in 1835 it was incorporated as a village, and in 1902 the villages of Fulton and Oswego Falls consolidated and were incorporated as the city of Fulton. A Federal estimate in 1916 indicated a population of 11,908, an increase of 1,428 since 1910. The area of the city is a little more than three square miles.

Fulton has a considerable trade in milk and tobacco. Its principal industrial plants include paper mills, canneries, flour mills and manufactories of infants' food, chocolate, firearms, woolen goods and paper-mill machinery. About 2,800 people are employed in the factory of one woolen company. Fulton is also actively engaged in the building of motor boats, canoes and yachts. A post office, erected in 1915, a city hall and a public library are the most notable buildings. City Park, Schenck Park and Fultonian Park are attractive recreation and amusement spots. D.S.H.

FULTON, Robert (1765-1815), an American engineer, inventor of the first successful steamboat and of the first steam-propelled war vessel. Though he hit upon the idea of steam navigation independently, he was not the first to [illegible] but this by no means detracts from [illegible] his achievement (see Fitch, [illegible] was born at Little Britain, Pa., a town which has since been rechristened Fulton, and because of the poverty of his parents he was in school only long enough to learn to read and write. While working for a jeweler he took up portrait and landscape painting with such success that he was able to buy a farm and in 1787 to go to London to study painting with his noted fellow-countryman, Benjamin West. Acquaintances whom he made there discovered in him the mechanical genius which he himself seems not to have felt, and induced him to devote himself to engineering. A patent for a double-inclined plane to be used instead of canal locks, patents for flax-spinning and rope-making machines and for a marble-cutting mill—these were evidences that his genius was of the practical and usable kind.

ROBERT FULTON

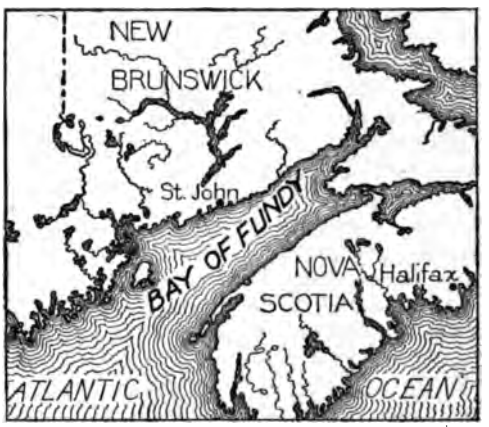
In 1796 he went to Paris and there worked diligently upon one of his great ideas—a submarine torpedo boat. Though he demonstrated the value of his invention, neither the French nor the English nor the American government was interested in it, and he turned his serious attention to the making of a steamboat. The first successful one was launched on the Seine in 1803, but the French government refused to take up this invention also, and Fulton returned in 1806 to the United States, having first revisited England and sent home an engine. In 1807 he launched upon the Hudson the famous *Clermont,* which puffed slowly up the river to the amazement of the thousands of spectators who had gathered to watch the wonder. Five miles an hour was its average speed, but an increase in that proved a comparatively easy matter when once he had established the principle. Later Fulton constructed for the United States government various engineering works and the steam frigate *Fulton,* launched in 1815, and was engaged on an improvement of his submarine torpedo when he died. Great honor was paid him in his latter years, and he had the happiness of knowing that his work was appreciated. He might have been wealthy, but lawsuits over the infringement of his

patent rights kept him almost poor, and hastened his death. In 1909 a centennial celebration of the launching of the *Clermont* was held, and an exact model of that boat steamed slowly up the Hudson.

Consult Knox's *Life of Robert Fulton;* Thurston's *Robert Fulton: His Life and Its Results.*

FUMIGATION, *fu mi ga'shun,* the act of applying fumes or smoke for various purposes, such as the disinfection of clothes or houses. The agents that are generally employed for this purpose are sulphur, formaldehyde and chlorine gas. Sulphurous gases, formerly used as disinfectants, have irritating qualities, and as they tarnish all silver and brass and have an unpleasant odor they have been generally superseded by formaldehyde solutions, which cause no damage and are efficacious in destroying infectious germs. In many large cities the quarantine stations have established plants for producing steam, which is used to obtain sterilizing heat. After fumigation has taken place the room should be kept closed for six hours, then be thoroughly ventilated and opened to sunlight. If an unpleasant odor remains it may be dissipated by the use of small open vessels filled with ammonia. Thorough cleaning and sunning of rooms should always accompany fumigation, as the latter is not an infallible process. See DISINFECTANT; FORMALDEHYDE. W.A.E.

FUNDY, *fun'di,* BAY OF, an arm of the Atlantic Ocean, separating the southern part of



LOCATION MAP

the Nova Scotia peninsula from New Brunswick. It is 180 miles in length, with an average breadth of thirty-five miles; at the mouth its breadth is forty-eight miles. At the head it divides into two branches, that on the north called Chignecto Bay, and the southern, Minas Channel, which gives entrance to Minas Basin and Cobequid Bay. On its northern shore it receives the waters of the Saint John and the Saint Croix rivers, both of which form part of the international boundary between New Brunswick and the state of Maine.

The bay is noted for its high tides, which sometimes rise nearly sixty feet and cause dangerous bores or tidal waves. There is a general belief that the tides here are the highest in the world; this is an error, since they reach equal heights in numerous other places. Fogs are frequent in the bay and make navigation difficult. Passamaquoddy Bay, opening off its western shore, is a magnificent natural harbor. The chief ports on the Bay of Fundy are Moncton, Saint Andrews and Saint John in New Brunswick; Annapolis and Digby in Nova Scotia. At the entrance there are numerous islands off the coasts of Maine, New Brunswick and Nova Scotia.

FUNGI, *fun'ji,* flowerless plants which have no green coloring matter (chlorophyll) to help them assimilate food, so they live on other plants or animals, either dead or alive. It has been estimated that there are about 250,000 fungi, only about one-third of which have been described. They grow everywhere—in water and in and above the soil. Some are so small they cannot be seen with the naked eye; others are threadlike, and some, like the toadstools, grow as high as two feet.

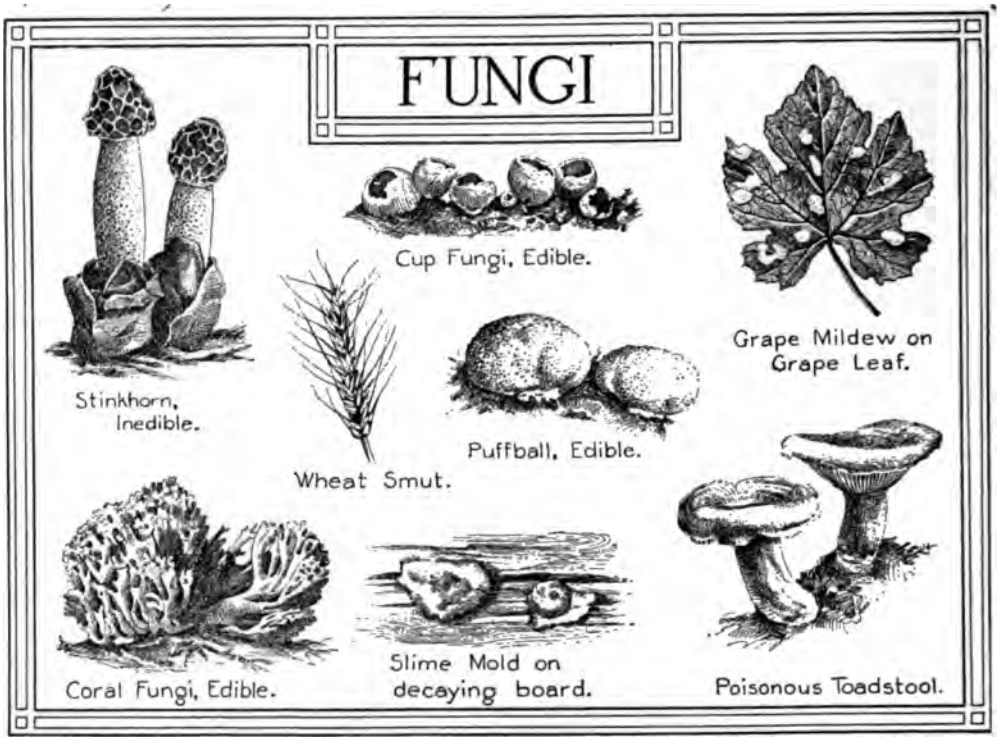
There are two general classes of fungi; one comprises those which live on dead or decaying things, known as the *saprophyte* fungi; the other is the *parasite* fungi, which grow on living plants or animals. Some species, including the mushrooms and truffles, are edible; others are used in medicine and the arts, and all are beneficial in that they turn plant matter back into soil. But many species are very destructive; among these are the smuts, rusts, mildews and molds. Many others cause diseases in man and animals. See page 2350 for illustrations.

Related Subjects. The reader is referred to the following articles in these volumes:

Bacteria and Bacteriology	Rust
Mildew	Smut
Mushroom	Yeast

FUNGICIDES, *fun ji'sydz.* See INSECTICIDES AND FUNGICIDES.

FUNSTON, *fun'stun,* FREDERICK (1865-1917), major-general of the United States army, seasoned veteran and modern military hero. He



traveled from the arctic regions to the tropics, in various capacities, finding adventure everywhere. Born at Carlisle, Ohio, he was successively instructor in the state university at Lawrence, Kan., a farmer, train conductor and newspaper reporter. In Alaska, where he was sent by the United States Agricultural Department to report on the plant life of the country, he made the longest trip ever attempted by a white man on snowshoes. He paddled down the Yukon in an open boat and absolutely alone, a distance of 1,100 miles, and secured important botanical specimens.

MAJOR-GENERAL FUNSTON

In 1896 he joined the insurgents in Cuba under General Garcia, against the Spaniards, was wounded three times, and later captured by the Spaniards. Upon his release, he returned to the United States. At the outbreak of the Spanish-American War, the "Fighting Bantam of the Army," as Funston was called (he was only five feet tall), became colonel of the Twentieth Kansas Volunteers, and was ordered to the Philippines, where many daring exploits made him the military hero of that war. After the capture of Aguinaldo, which is the most celebrated, although not the most thrilling, of his adventures, President McKinley appointed him brigadier-general. He was placed in charge of the work of restoration of peace and order after the San Francisco earthquake in 1906. When trouble with Mexico seemed certain in 1913 he was given command of the American troops at Vera Cruz, where his varied experience again made him of invaluable service to his nation. In 1916, when the United States sent an expedition into Mexico to capture the bandit Villa, who had fallen from his high estate as a popular leader of the revolution, Funston was put in command of the situation. He did not accompany the forces south, however, the immediate command being given to his subordinate, General Pershing.

On February 19, 1917, General Funston dropped dead in a San Antonio (Tex.) hotel. The cause of death was given as hardening of the arteries. His body was conveyed to San Francisco for burial.

FUR AND FUR TRADE. Ever since the beginning of history the skins of certain animals have been eagerly sought, either for personal adornment or for use as protection against the cold. The winter covering of animals living in northern latitudes provides the choicest fur, and men willingly risk their lives, year after year, spending the winter months in the frozen wilderness to bring back to civilization in the spring the results of their skill as hunters and trappers. The animals chiefly sought are the seal, beaver, badger, marten, ermine, muskrat, fox, skunk, wolf, wolverine, lynx, sable, mink, otter and bear. The trapper does not in any way prepare the skins for market; he stretches them over boards, dries them in the cold air and delivers them in that condition to the buyer.

So great is the present demand for furs that to meet the supply nearly 145,000,000 wild animals are killed every year. The best furs are obtained during the coldest weather in the coldest regions of the earth. At such times fur-bearing animals are provided with a thick woolly covering beneath the long hairs of the fur, and to this extra covering is due the value of the pelt. Trading posts have been established in all fur-bearing countries, with stores from which trappers may purchase supplies. At these posts huge quantities of skins are collected, to be later sold by auction in the world's great fur markets, the chief of which are London, England; Leipzig, Germany, and Nijhni Novgorod, Russia.

Fur Trading Companies. The fur trade of America has for more than two centuries been of great importance. Early settlers established a chain of trading posts extending from Hudson Bay to New Orleans. Bitter war was waged between British and French companies, in which the Indians often took sides. The French were gradually forced from the Canadian fur-trapping grounds. In 1760 Charles II of England granted a monopoly to a company founded under the name of the Hudson's Bay Fur Trading Company. The monopoly was confined at first to the regions around Hudson Bay, but eventually the company extended its operations to every part of Canada. In 1869 the government of Canada paid to the Hudson's Bay Company the sum of $1,500,000 as compensation for surrender of its monopoly and territories held; since that time equal privileges have been extended to all. The principal rival of the Hudson's Bay corporation is Revillon Frères, usually spoken of as the "French Company," with many trading posts, some standing almost side by side with those of the Hudson's Bay Company.

Alaska produces the greater part of the fur supply of the United States. Until 1913 these furs were nearly all sent to London to be dressed and cut, only a few finding their way direct to American factories. Indeed, the American market is still small, and most of the furs sold in the stores of the great cities have been sent first from Canada and Alaska to London or Leipzig. The Alaskan seal fisheries are of great importance, but the number of seals that may be killed each year is now strictly regulated by the United States government. Attempts are being made to develop the fur market of Saint Louis, and in 1913 the greater portion of the skins from Alaska were sent there. The War of the Nations practically closed the European markets for a time, and gave an added impetus to American enterprise.

Canadian Furs. The total value of the furs annually produced in Canada is estimated at about $2,000,000. Muskrats head the list, with a total of nearly 1,000,000 skins valued at $256,000. Martens and minks are valued at over $220,000; beavers, $131,000; ermine, $22,000; wild foxes of all kinds, $185,000; otters, $102,000; skunks, $17,515; fur seals, $5,000; lynx, $114,756; wolves, $16,452; bears, $45,000.

Fur Farming. A new and important industry has been created in Canada in the breeding of black foxes. This has extended from Prince Edward Island, where it originated about 1900, to Nova Scotia, Quebec and other eastern parts of the Dominion. The fur of the black and silver tip foxes occupies such a place among furs as is held by diamonds among jewels. It cannot be artificially duplicated, and it is so

much desired by the wealthy that a good skin is worth $4,000 or $5,000. The Canadian government has encouraged the industry, which now represents investments of more than $12,000,000. A pair of foxes for breeding purposes will command as much as $30,000 or $40,000 in the open market. Skunks are raised on many farms in the United States, and the industry proves profitable. Minks are also bred in captivity, but the quality of the fur does not equal that of the mink of the frozen north.

Prices of Furs. The price of furs varies perhaps more than that of any other commodity of changeable value, and ranges for a hide from a few cents to several thousand dollars. In the early days of the Hudson's Bay Company the most valuable furs could be bought from Indians for a few glass beads. Rifles were sometimes exchanged for furs; sometimes the Indian trapper was made to build a pile of furs, laid flat one above another, to the height of the gun in payment. The rifles were of the old-fashioned, long-barreled type, costing only a few dollars. The pile of furs would sometimes be worth thousands of dollars to the white man, but the Indian could not appreciate their value. Methods have now greatly changed, and the fur companies have established a reputation for fair dealing. Assistance is given to trappers who are left entirely without means if they have a bad season. The Hudson's Bay Company always extends credit to its trappers, and assists them until a good season comes. The price paid to the trappers is, of course, less than the open market price, but in a fair season a skilful trapper may make considerably more than enough money to keep him through the spring and summer. The prices quoted in the following list of most commonly used furs are about the average paid in the open markets:

Beaver, $5 to $25	Ermine, 25¢ to $2.50
Chinchilla, $4 to $12	Fox, silver, $1,200 to $5,000
Fox, red, $1 to $8	Lynx, $5 to $35
Marmot, 25 to 60 cents	Marten, $5 to $20
Mink, $3 to $10	Muskrat, 10 to 50 cents
Sea otter, up to $3,000	Otter, $10 to $35
Raccoon, $1 to $5	Sable, up to $50 or $60
Skunk, $1 to $3	Seal, $5 to $20
Squirrel, 5 to 15 cents	Wolf, $5 to $10
Civet, 25 to 50 cents	

How Animals Are Skinned. The skinning of trapped animals is an operation requiring great care, as any damage materially lowers the value of the pelt. In the piercing cold of the far north the animals are generally frozen hard and stiff when removed from the trap. Before they can be skinned they must be thawed in the hut of the trapper. The skins of all small animals such as minks, martens, otters, foxes and ermine are removed "closed." With a sharp knife a cut is made from the center of the hind claws up the leg, across the body and down the other leg to the claws. The tail is skinned by forcibly removing the stump without cutting the skin, which is then turned inside out and removed from the body like a glove. The skin is then stretched on a piece of wood of the proper shape, with the fur inside. The skins of larger animals, such as wolves and bears, are removed by being cut from the throat the full length of the body.

Fur Dressing. It is generally admitted that the German furriers excel in dressing small skins and those that require delicate handling, while the English methods are best for heavy furs. The first process of dressing is to clean the skin and carefully remove all traces of fat and flesh. Grease is then rubbed in carefully, the skin being thoroughly kneaded. Great care is taken to preserve the natural oils of the fur. Matching of skins requires skill and a good eye for color, as the effect of a garment might be spoiled by use of skins of different shades.

Imitations. A large number of imitation furs are placed on the market, and the workmanship is so skilful that it is very hard to discover the difference between them and the genuine. Some imitations are sold with the clear understanding that they are not genuine, but deliberate deception is often practiced. The domestic cat provides a wide variety of furs, when carefully prepared and dyed. White rabbit fur is often sold as ermine, chinchilla or even fox. The muskrat provides a fur that lends itself readily to imitations, and it appears as seal, mink, sable and otter. Dyed hare skins are sold as sable, fox or lynx. Common red fox skins are dyed to imitate black fox, and with white hairs added, are offered for sale as silver fox. It is easy to distinguish badly or heavily dyed imitations, as the under fur is darkened beyond its natural state and the skin itself is stained, but a cleverly-dyed skin will deceive all but the expert. Especially in lightly-dyed furs, when perhaps only the tips of the hairs have been treated, anyone but an experienced furrier would be deceived. The prices offered for imitations are usually much less than the recognized price of genuine articles. F.ST A.

Related Subjects. Each animal referred to in the above article is described in its alphabetical place in these volumes. In addition, see the following:

Canada, page 1102 Hibernation
Game (Game Laws) Seal

FURIES, *fu'riz,* in Greek mythology, three sisters named Alecto, Tisiphone and Megaera, who were attendants of Proserpina, the goddess of death and the underworld. They sprang from the blood of the wounded Uranus, and were noted for their hard hearts as well as the merciless manner in which they hurried the ghosts intrusted to their care over the fiery flood of the river Phlegethon to eternal torment. Their heads were wreathed with serpents and they watched remorselessly for every soul they could catch. Virgil says in describing Hades:

"before the gate,
By night and day, a wakeful Fury sate,
The pale Tisiphone; a robe she wore,
With all the pomp of horror, dy'd in gore."

FUR'LONG, an English term for the distance of forty rods, or one-eighth of a mile. It originally referred to the length of a furrow, which would ordinarily be the length of a field, but like other originally indefinite terms of measure, it gradually acquired a definite value. Among the old English writers one-eighth of a mile of any of the world's standards of measurement was called a furlong, and as early as the ninth century the word was used in the sense of the Latin *stadium,* which was one-eighth of the Roman mile. The term is now little employed. See MILE.

FUR'NACE, an enclosure or structure of metal, brick, earthenware or other material, in which a fire developing great heat may be maintained. The heat is utilized for melting metals, heating a boiler, baking pottery, warming a house and for many other purposes. The furnace should be so constructed as to provide the greatest possible heat from the fuel consumed, and to concentrate the heat where it is most required. The fire in ordinary *air furnaces* is kept burning by natural drafts. When extreme heat is required air is forced through the fire by bellows or blowing machines. Furnaces fitted with such devices are called *blast furnaces.* For melting metals a *reverberatory furnace* is sometimes used. In this device the flames are forced against a low, arched roof from which they are deflected to the objects to be melted.

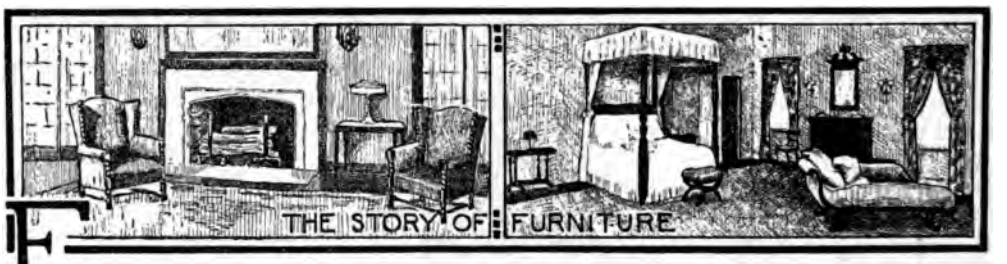
The furnaces mentioned above burn coal or coke. Furnaces requiring gas fuel are becoming steadily more important and have great advantages over those burning coke or coal. Gas leaves no ash; it produces a very high temperature and can be instantly lighted or extinguished.

Electric Furnace. The electric furnace, which is of recent invention, has proved so successful that it is expected to revolutionize the steel industries, for by means of it a temperature far higher than that ordinarily reached in any of the older types of furnaces is easily obtained. To the reader without a technical knowledge of such matters it might seem that the temperature of 2000° Centigrade obtainable in a non-electric furnace must be high enough for any process, but the worker with metals finds that there are various processes which can be far more satisfactorily carried on by means of the 3500° temperature which the electric furnace affords. Carborundum, graphite, high grades of iron and steel, calcium carbide and aluminum are best produced in this intense heat.

Electric furnaces are of two types, resistance furnaces and arc furnaces. In the former, a very refractory material—in other words, a very poor conductor—is made use of, and the passage of electricity through that substance causes the heat. In the arc type, a great electric arc is formed of carbon, and is enclosed in a chamber formed of some substance which will allow neither the electricity nor the heat to escape. Of course electric furnaces are practicable only in regions where electric power can be generated without great expense. See ELECTRIC HEATING.

FUR'NESS, HORACE HOWARD (1833-1912), an eminent American Shakespearean scholar who probably knew more about Shakespeare, his plays, their sources and texts, than any other man since the days of that greatest of all dramatists. In 1871 he published the first of his famous series, known as the *Variorum Shakespeare,* which included fifteen volumes, each a monument of patient study.

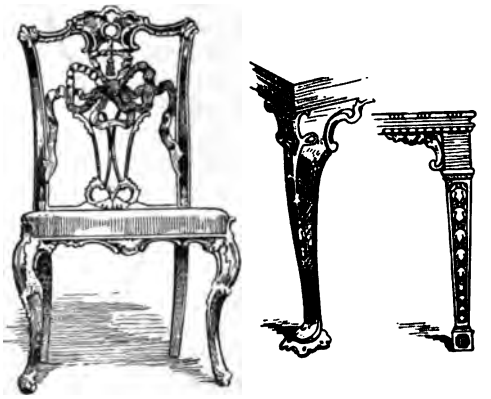
Dr. Furness was born in Philadelphia, was educated at Harvard College and at Halle, in Germany, and was admitted to the bar in 1859. He represents the finest type of the leisurely scholar; but neither the deafness with which he was afflicted nor his seclusion from the activities that make up modern life could make him unsympathetic with his fellowmen. It is said he always carried in his pocket a card upon which was written, "Don't blame the driver. It is not his fault. I am deaf."



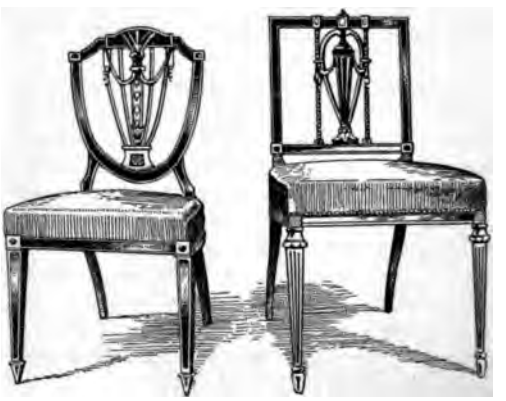
FURNITURE. The furnishings of the typical modern household are the result of little more than four centuries of furniture-making, for furniture in the present sense of the word is a development of our later civilization. Marbles, and such costly woods as cedar and ebony, and ivory, bronze, gold, silver and precious stones have been used from earliest times in the construction and decoration of household furnishings, but even the most magnificent mansion of the ancient Egyptians, Assyrians, Greeks or Romans lacked many of the familiar appliances found to-day in the humblest home. The chair, the couch, the table and the bed were the principal articles of furniture used by ancient and medieval peoples. In Europe, fixed tables were the exception until the sixteenth century, the usual custom being to lay sets of boards across uprights when it was time to serve meals, and chairs did not become common until the seventeenth century. A modern householder would think the medieval castle of the European nobleman a meagerly-furnished place indeed

The Notable French Periods. The awakened interest in all forms of art was extended to furniture during the period of the Renaissance (which see), and Florence, Rome, Venice and Milan became important centers of cabinet-making. The Italian influence was felt especially in France, where, during the reigns of Louis XIV, XV and XVI, furniture of the most exquisite design was produced. Under the first of these three monarchs the curved line in furniture became established; in the reign of Louis XV the love of ornamentation reached its height, many of the cabinets, commodes, bureaus and bookcases of the period showing painted landscapes elaborate in design and brilliant in hue. Marvelous effects were also produced through carving, inlaid work and the use of bronze or brass ornamentation. In this reign also there was a return to the straight line in furniture, which prevailed through the next period. Mahogany became the favorite wood of the cabinet-makers under Louis XVI, but gilded or enameled walnut was also used. Among the most notable achievements of this period are the Louis XVI chairs and sofas, with fluted, tapering legs, and carved frames enclosing beautiful tapestry backs. During the empire, grace, elegance and refinement in furniture were replaced by heaviness and solidity; this is known as the period of decline.

English Development. In England, as in France, the eighteenth century was a period of achievement in cabinet-making. Under the



CHIPPENDALE DESIGNS
Chair, and cabriole and taper legs of tables.



SHERATON CHAIRS
Two chairs in the characteristic Sheraton designs.

Louis XVI

four Georges, from about 1715 to 1830, mahogany took the place of walnut and oak, previously used, and the furniture of the period shows a decided contrast to the massive, square types especially characteristic of the Elizabethan Age. Grace and beauty mark the work of the three great masters of the Georgian period—Thomas Chippendale, "the master of line," George Heppelwhite, "the exponent of elegance," and Thomas Sheraton, "the purist." Each of these cabinet-makers set a fashion in furniture which has become an established vogue.

Chippendale's chairs best represent his genius (see illustration). These are characterized by the curved leg (cabriole), with ball and claw foot, the outward-curving side frames of the back, and the top rail shaped more or less like a cupid's bow. Especially beautiful in design are the centers of the backs, which he filled in with carved ribbon or lattice work, showing an almost limitless variety of figures. Chippendale's name is also associated with china cabinets and bookcases with glass fronts, writing desks with glazed doors, settees beautified by fretwork, and tables of various designs. His furniture is notable both for its solidity and its delicacy.

Louis XVI

In the construction of his chairs, Heppelwhite, like Chippendale, produced his most characteristic designs. The backs are usually oval or shield-shaped, with decorative middle-pieces, and the legs are square and tapering. Exquisite proportion gives these chairs an effect of remarkable elegance and refinement. Heppelwhite also perfected the sideboard in its modern English form, and his furniture shows the most tasteful use of inlay and veneers in the history of English cabinet-making. To him also are attributed many choice urn stands, tea trays, chests and caddies.

Sheraton's name is associated especially with furniture decorated with painting. He worked both in mahogany and in satinwood, and in his tasteful use of inlay he was almost the equal of Heppelwhite. Practicability as well as beauty distinguishes his furniture. He invented a summer bed divided in the center in such a way as to permit a better circulation of air, a hollow-front sideboard and the work table with a pouch of silk on each side, which is still popular with housewives. His satinwood furniture consisted mainly of commodes, bureaus, small writing desks, toilet tables and other boudoir furnishings, many of which were exquisitely decorated with painted designs.

Louis XVI

Modern Taste in Furniture. All of the French and English eighteenth-century styles of furniture have been copied by European and American manufacturers, and these have made their way into many twentieth-century homes; but recent years have seen an ever-increasing popular demand for furniture which is in keeping with present-day ideals of utility, comfort and beauty. Simplicity and durability, typified by the dignified and substantial mission furniture and its modifications, are qualities which commend themselves to the best modern taste. "Have nothing in your room that you do not know to be useful," is sound advice from that famous English manufacturer of artistic furniture—William Morris (which see). The practice of filling the house with useless bric-a-brac, cheap pictures and vases, tables and chairs with fragile legs and furniture that is weakly constructed and showily decorated cannot be too strongly condemned. Plain, well-made artistic furniture, which lasts indefinitely and can be easily kept in sanitary condition, lends dignity to the humblest home.

Popular Woods. Oak has long been a favorite wood for the furnishings of hall, library and dining room; mahogany, curly birch and maple are all utilized for bedroom furnishings, and mahogany is widely used both in the dining rooms and drawing rooms of the better-furnished homes. Circassian walnut, a beautiful Russian wood, is an established favorite in America for bedroom furniture. The better woods being expensive, veneering is much employed.

The American Furniture Industry. There are in the United States about 3,200 factories for the manufacture of furniture, which require the services of nearly 130,000 men and women. The value of the yearly output to the manufacturers is about $371,000,000. The three leading states in the industry are, in order, New York, Michigan and Illinois, the two latter being practically equal in value of products. The chief centers for the manufacture of furniture are New York, Chicago, Grand Rapids (Mich.), Philadelphia, Saint Louis and Boston. Until about 1900 Grand Rapids was the greatest furniture manufacturing city in the world.

It is interesting to note that the familiar rocking chair is entirely an American creation, and so, too, are the folding bed and its adaptations, and the chiffonier. In equipment and organization, American furniture factories are superior to any others throughout the world.

In the Dominion of Canada there are over 170 furniture factories, representing an investment of about $6,500,000. Ontario, with about 120 factories, is the most important center of the industry, and Quebec, with about forty, is next in rank. B.M.W.

Consult Lockwood's *Colonial Furniture in America;* Litchfield's *Illustrated History of Furniture.*

FUR'NIVALL, Frederick James (1825-1910), an English philologist and one of the most influential workers in the history of English scholarship. He will be remembered through his success in founding, for the publication of texts, The Early English Text Society, The Chaucer Society, The Ballad Society, The New Shakespeare Society, The Browning Society, The Wycliffe Society and The Shelley Society. Chiefly through the medium of these societies, he edited numerous manuscripts, including his monumental work—the Six-Text edition of Chaucer's *Canterbury Tales.* He likewise edited a series of forty-three facsimiles of the quartos of Shakespeare's plays, a work which won for him his greatest distinction, from an American standpoint. Dr. Furnivall was born at Egham, in Surrey, and was educated at University College, London, and at Cambridge.

FUR SEAL. See Seal, subhead *Fur Seal*; Fur and Fur Trade.

FUSE, *fuze,* an abbreviation of *fusil,* meaning *a gun,* is the name given to many devices used for discharging explosives in guns, shells and mines. The simplest form of fuse is made of waterproofed jute yarn spun round a core of explosive powder. The explosive is usually of gunpowder, mixed with chemicals to make it burn slowly. One end of the fuse is connected with the charge to be exploded, the other end being ignited. The fuse burns until the sparks reach the charge, when the explosion occurs. Ordinary fuse of the type mentioned above burns at the rate of one foot in half a minute. All blasting operations formerly were thus timed by regulating the length of fuse, but charges are now usually fired by electric fuses. A metal cylinder, containing two copper wires connected by a very fine fusible wire, is filled with explosive and placed in the blasting charge. An electric current is sent through the wires, causing the thin connecting wire to fuse and produce a spark which sets fire to the charge.

FUSING POINT. See Melting Point; also Freezing.

THE WORLD BOOK
ORGANIZED KNOWLEDGE IN STORY AND PICTURE

Gg

G, the seventh letter in the English alphabet, derived, like almost all the others, from the Phoenician. The name for it in that language was *gimel*, or *gamel*, which meant that most important of all animals at the time, the camel, and the letter itself was at first probably a rude picture of a camel. Later it was more and more carelessly drawn, until it looked much like the figure 7, and this symbol the Greeks, who borrowed the letter and saw in it no relation to any animal, turned around (see C). Their *gamma*, like the Phoenician *gamel*, had only the hard sound of *G*, as in *go*, but the Romans when they borrowed it made it stand for that sound and the sound of hard *c*, as well. The Romans also made it a curved letter, so that it looked like the modern *C*, and gradually, as they distinguished between the two sounds it bore, they added a little bar below the opening to show that one was *G* and one was *C*.

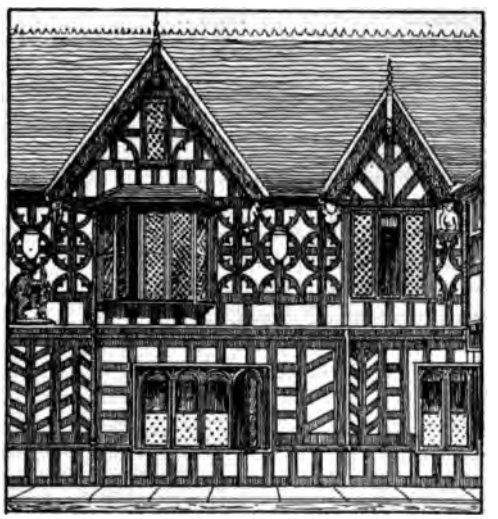
In English the letter has two distinct sounds, the so-called soft sound as in *gem*, and the hard, as in *gave*. Most commonly the hard sound is given before the vowels *a*, *o* and *u*, as in *gale*, *got*, *gull*, and at the end of a word, as in *big*; the soft sound occurs before *e*, *i* and *y*, as in *gentle*, *gist*. To this rule there are numerous exceptions. In music, *G* is the fifth tone in the major scale of *C*.

GABERS, *ga'burz*. See GHEBERS.

GABLE, *ga'b'l*. When a building has a "peaked" or sloping roof there is formed at each end a triangle between the eaves and the ridge of the roof. This triangular upper part of the end wall is called a gable—a name which comes from an old Celtic word meaning *fork*. In his poem of *Evangeline* Longfellow writes, describing the picturesque homes of the Acadian peasants:

> Thatched were the roofs, with dormer windows; and gables projecting
> Over the basement below protected and shaded the doorway.

Gables were extremely popular with medieval builders, and in many old European cities —such as Brussels, Bruges, Antwerp, Louvain and Nüremberg—the traveler will still see steep-roofed houses and town-halls that were built during the fourteenth and fifteenth centuries, their quaintly-ornamented gables facing the street instead of being at right angles to it, as is the usual custom in our day. In the gables of Holland, Belgium and Germany especially, square indentations called *corbie steps* were frequently cut into the sides of the tri-



GABLE OF ELIZABETHAN PERIOD

angle, making what is known as a *crow gable* or *stepped gable.*

GA'BRIEL, in Bible story, was the favorite of the seven archangels of Jehovah, and the one chosen to carry His messages to mortals. The name, which means *hero of God,* indicates how well fitted this angel was to inspire with courage and faith the person to whom he carried the message. We first hear of Gabriel in the eighth and ninth chapters of *Daniel,* when he interprets the prophet's vision of the ram and the he-goat, and later brings the explanation of the seventy weeks.

In the New Testament he announces to Zacharias the birth of John the Baptist, *Luke* I, 19, and to Mary the birth of Christ, *Luke* I, 26. The announcement of Christ's birth to the Virgin Mary by the angel Gabriel has been represented in art by many great masters. These paintings, which bear the name *The Annunciation,* are in many famous galleries of Europe. The best are those of Murillo, in the Madrid and Seville museums; of Fra Angelico, in the Madrid Museum; of Fra Bartolommeo, in the Louvre; and of Titian, in Scuola di San Rocco, Venice. See ANNUNCIATION, THE.

GADFLY. See HORSE FLY.

GADS'DEN, ALA., the county seat of Etowah County, situated in the northeastern part of the state, fifty-six miles by rail northeast of Birmingham. It lies to the southwest of Lookout Mountain, and is on the Coosa River and on the Chattanooga Southern, the Louisville & Nashville, the Southern, and the Nashville, Chattanooga & Saint Louis railroads. In 1910 the population was 10,557; in 1916 it was 14,642, by Federal estimate. Gadsden is in the vicinity of rich coal and iron-ore mines and yellow-pine forests, and has important trade interests. The industrial establishments of the city include steel mills, lumber mills, wood-working plants, blast furnaces, foundries, machine shops, car works and cotton mills. The city has a marble Federal building and attractive churches and schools. Gadsden was settled about 1845 and incorporated in 1867.

GADSDEN PURCHASE. On June 30, 1854, an international treaty of sale was ratified wherein the United States purchased a tract of land south of the Gila River in Arizona from Mexico for $10,000,000. James Gadsden, United States minister to Mexico, conducted the treaty negotiations with Santa Anna, and the sale met with so much opposition in Mexico that Santa Anna was banished from his country the following year. The purchase was made to settle a dispute over the boundary line between Mexico and the United States, and by it the latter country acquired 45,535 square miles of territory.

THE GADSDEN PURCHASE

GADSKI, *gaht'ski,* JOHANNA W. TAUSCHER (1872-), a German soprano, whose powerful voice and wonderful dramatic ability have won her fame in many Wagnerian rôles. She was born and educated in Prussia, and after making her debut in Berlin at the age of seventeen as Nudine in Lortzing's opera of that name, she was engaged there to sing during each season for the next four years. In 1892 she married H. Tauscher, an officer in the Austrian army, but continued her public work. After touring in Holland and Germany she made her debut in New York at the Metropolitan Opera House in 1895, under Walter Damrosch. From that time, when she sang as Elsa in *Lohengrin,* her fame has been secure. In 1898 she joined the Metropolitan Opera Company, since which time she has sung in nearly every large city in Europe and America. Her audience is always thrilled by her deep, rich voice and commanding presence as well as by her power to enter into the personality of the character which she portrays in the opera. The kingdom of Bavaria presented her with a gold medal for art and sciences.

MADAME GADSKI

GAD'WALL, or **GRAY DUCK,** a favorite game bird esteemed for the table on all continents. It is black and white, marked with brown, and is from twenty to twenty-two

inches long, not quite as large as the mallard, which it resembles in voice and habits. Shy and fearful of enemies, it sleeps in the grasses of shallow lakes and ponds in midday, and feeds during morning and evening twilight on grains and small water animals. In its grassy

THE GADWALL

nest it lays eight to twelve creamy-white eggs. In America it breeds from Southern British Columbia, Central Alberta and Central Keewatin south to states north of Kentucky, migrating in winter as far south as the Gulf States. To sportsmen of the Atlantic coast, however, this bird is practically unknown. See DUCK.

GAEL, *gale,* the name of that branch of the Celtic race inhabiting the Highlands of Scotland, Ireland and the Isle of Man. The Highlanders of Scotland call themselves the Gaels of Albion, while the Celts of Ireland style themselves the Gaels of Erin. The term *Gaelic* is applied by some to the Irish language in general, but it is usually restricted to the Celtic dialect spoken in the Highlands of Scotland.

GAGE, THOMAS (1721-1787), an English general who became famous as the colonial military governor of Massachusetts. He was born at Firle, in Sussex, received a lieutenant's commission in the English army in 1741 and accompanied Braddock to America in 1754. Gage was with that general when he marched his army through the wilderness as though he were on a parade ground and was ambushed by the Indians. He raised a regiment of troops in 1758 and commanded it in the Ticonderoga siege under Amherst, who made him governor of Montreal in 1760. From 1763 to 1772 he was chief of the English forces in America, but later returned to England.

In 1768 he was ordered to return to Boston for stricter enforcement of the Boston Post Bill and Stamp Act, as King George had discovered that money was not coming in fast enough for the support of his army in America. He found the Bostonians undaunted. His troops took delight even in demolishing the snow forts and skating places of the small boys of the town. When the latter could stand it no longer they called in a body on the general and demanded that he make his soldiers let their playgrounds alone. He complied with their request, adding, "even the children make demands for their rights." The first battle of the Revolution was fought through his order to seize the military stores at Concord, and when, after the Battle of Bunker Hill in 1775, the British were nearly conquered, Gage was recalled to England and Howe was assigned to his command.

GAILLARD, *gal'lard,* CUT, the name of the former Culebra Cut. See PANAMA CANAL.

GAINESVILLE, *gaynz'vil,* FLA., the county seat of Alachua County, a favorite winter resort for invalids, especially for those with diseases of the lungs. It possesses a certain historic interest, as it is in the old Seminole Indian territory, and it has such show spots in its neighborhood as Devil's Mill Hopper, Newman's Lake and Alachua Sink, which is now a stretch of grassy prairie, now a clear, shallow lake. The University of Florida, one of the newest of the state universities, is located here, and there are yearly sessions of the Chautauqua and of the Florida Winter Bible Conference.

The city is seventy miles southwest of Jacksonville, on the Seaboard Airline, the Tampa & Jacksonville and the Atlantic Coast Line railroads. It is of importance because one of the richest sections of the phosphate mining region lies but fifteen miles away, while oranges, grapefruit, melons and sea island cotton are grown in the vicinity. The electric light plant and the water works, which bring the city water from one of Florida's numerous springs, are owned by the municipality. Gainesville was founded about 1850, incorporated as a town in 1869 and given its city charter in 1907. Population, 1910, 6,183.

GAINSBOROUGH, *gaynz' b'ro,* THOMAS (1727-1788), an English portrait painter famous for his wonderful, cool, fresh coloring and his power for portraying personality. That he had many fashionable beauties as clients is well shown in *Mrs. Siddons* or the *Duchess of Devonshire,* two of the most popular of the 220

portraits which he painted. He was born of middle class parents in Sudbury, Suffolk. As a boy he often played truant from school that he might sketch; in this he showed such remarkable talent that his father sent him to London at the age of fifteen to study. After an unsuccessful attempt to establish a studio in that city he returned to his home town in 1745, where he married Margaret Burr. They soon moved to Ipswich, where for fourteen years Gainsborough worked steadily, painting landscapes as well as portraits, but when in 1760 he moved to Bath, orders were heaped upon him for portraits, until he acquired such a reputation that George III, upon hearing of his return to London in 1774, invited him to paint portraits of the queen and himself. All the fashionable world followed the king's example, which resulted in great prosperity for the artist, which did not abate during his life.

In 1768 Gainsborough became one of the thirty-six original members of the Royal Academy, but four years before his death he withdrew all his pictures because he did not like their hanging-places. Although he rarely sold his landscapes, he painted for the love of the task gloomy forest shades or rough broken country; *The Watering Place,* in the National Gallery, London, is a characteristic example. Of all his portraits, *The Blue Boy* is considered the best in its wonderful coloring, as well as in its airy and birdlike effect, but many others such as *Lady Ligonier, Perdita Robinson* and *Mrs. Graham* are equally as well known. The famous Gainsborough hat has been worn at various periods since he made it so popular.

GAL'AHAD, SIR, in the legends of King Arthur, was the noblest of the Knights of the Round Table, and the one who had the most important part in the quest for the sacred cup from which Christ drank at the Last Supper (see HOLY GRAIL). Sir Galahad is pictured in art, narrative and poetry as the type of ideal manhood, set apart from other men because of his wonderful strength and purity. This conception finds appropriate expression in the familiar lines from Tennyson's *Sir Galahad:*

> My good blade carves the casques of men,
> My tough lance thrusteth sure.
> My strength is as the strength of ten
> Because my heart is pure.

The different versions of the Sir Galahad legend vary in many details. He is represented as the son of Sir Launcelot and Elaine, and as [illegible]d by enchantment. In the stories of Sir Malory (which see), Sir Galahad, Sir Bors and Sir Percival are permitted to see the Holy Grail, after which the soul of Sir Galahad departs to heaven. "Then it seemed to the two knights that there came a hand from heaven and bore away the holy vessel. And since that time there was never any man so bold as to say he had seen the Holy Grail."

SIR GALAHAD

Drawn from the painting by Watts. Ellen Terry, the actress, was the model for the Galahad of the picture while she was the wife of Watts.

In Tennyson's *Idylls of the King,* Sir Galahad, on the last day of his quest, saw rising up before him, and stretching out toward a great sea, a bridge of a thousand piers, each of which, as he crossed, became a sweeping mass of flame. When he had passed far out on the great sea he was drawn into a celestial city whose spires and gateways gleamed white like pearls, and over which, in a mist of wondrous beauty, floated the Holy Grail.

GALAPAGOS, *gah lah' pah gos,* **ISLANDS,** a group of small volcanic islands in the Pacific Ocean, belonging to Ecuador. They lie directly on the equator and are about 600 miles

from the mainland. In 1858 these islands were explored by Charles Robert Darwin (which see) during the voyage of the *Beagle,* and they figure largely in his writings on the evolution of animals. They are peculiar in having almost no species of animals in common with South America. There are great numbers of birds, and tortoises of huge size are numerous. Spanish explorers named the group Galapagos, which means *tortoise.* Rats and mice were found by Darwin, but he was convinced that these animals had been introduced by ships of buccaneers who formerly made the islands their headquarters.

The total area of the islands is 2,400 square miles, more than half of which is occupied by the island of Albemarle. Turtles form the chief product. Sugar is grown and cattle-raising flourishes. The United States government endeavored to lease the islands for a naval station in 1911, but the negotiations failed. Population, about 400.

GALATE'A, the sea nymph of classic mythology whose story inspired Raphael's wonderful fresco *Triumph of Galatea,* in the Villa Farnesina at Rome, Handel's melodious secular oratorio, *Acis and Galatea,* and works of numerous poets and sculptors. She was the daughter of Nereus and Doris and has often been called the *queen of the sea.* Ugly, one-eyed Polyphemus loved her, but she gave herself to the Sicilian shepherd, Acis. Enraged at this, the monster, surprising them one day, crushed Acis beneath a rock, so turning him into a stream, which flowed to the sea to meet the beloved Galatea. The story of another Galatea is told under the title PYGMALION.

GALATIA, *ga la'shi a.* In 277 B.C. Nicomedes, king of Bithynia, invited three tribes of Gauls to aid him in conquering his brother. After accomplishing this the Gauls settled in central Asia Minor, which territory received the name Galatia from them. It was bounded on the east by Cappadocia, on the west by Phrygia, and did not reach the seacoast at any point. The Gauls shunned the cities as places of residence and occupied the country,

LOCATION MAP

but they exacted tribute from the inhabitants of the cities. In 189 B.C. the Roman consul, assisted by Eumenes, king of Pergamum, partially conquered them, but in 26 B.C. Augustus made their country a Roman province. The apostle Paul visited Galatia twice (*Acts* XVI, 6; XVIII, 23) and later wrote a letter to the people of the country, known as Paul's *Epistle to the Galatians.*

Epistle to the Galatians. When the Apostle Paul heard that the Jews had tried to make the Galatians think that he was not an apostle of God with a divine message, he wrote a letter to them. It will be known as long as the world stands as the *Epistle to the Galatians,* and is the ninth book of the New Testament. After expressing surprise that the people have so soon abandoned him and the Gospel, Paul defends himself against unjust criticism and warns them against those who wish them to keep the Law of Moses. He tells them to be kind to those who have done wrong and to help each other, guiding and encouraging them to follow Christ and His teachings.

GAL'BA, SERVIUS SULPICIUS (3 B.C.-A.D. 69), was a Roman emperor who came of a noble and wealthy family, and in his early years gave promise of remarkable ability. As general in Germany and proconsul to Africa he conducted successful campaigns which brought him triumphal honors. He then retired from public life until A.D. 61, about the middle of Nero's reign, when the latter appointed him general in Spain. There he incurred the displeasure of the emperor, who secretly ordered him to be assassinated. Hearing of this, Galba revolted, and on the death of Nero in A.D. 68 assumed the title of Caesar and hastened to Rome. His reign was short, as he soon became unpopular because of his weakness and miserly ways; in an attempt to quell a revolt he was attacked and slain.

GA'LEN, or GALE'NUS, CLAUDIUS (A.D. 130-200), a celebrated Greek physician and the most versatile writer of his day on medical subjects. He is said to have written 500 treatises on medicine, logic, grammar and ethics. Only eighty-three of those attributed to him are now acknowledged as genuine; some of the remainder are doubtful and others spurious. Galen was so successful as a physician that he earned the name of *wonder worker.* He was appointed physician to the emperor Marcus Aurelius, and, later, to his son and successor, Commodus. Until the sixteenth cen-

tury Galen was regarded as the highest authority on matters relating to anatomy and physiology.

GALE'NA, or LEAD GLANCE, a mineral which is found in large quantities and forms the chief ore from which lead is extracted. Galena is a compound or sulphide of lead, and usually contains about eighty-seven parts lead and thirteen parts sulphur; the ore also contains small amounts of silver, antimony, zinc, iron and bismuth. When the proportion of silver is high it is known as argentiferous galena. The ore is usually found in large cavities or chambers of limestone. Galena is a soft and brittle mineral, with a bluish-gray color, like that of lead, but brighter. In the United States galena is abundant, occurring in large quantities near Galena in Illinois, in Colorado, Idaho, Montana, and in smaller quantities in Iowa, Missouri and Wisconsin. It is also found in Mexico, England and Australia. Coarsely grained galena is used for glazing pottery, and is known as *potters' ore*. See LEAD.

GALESBURG, ILL., the county seat of Knox County, in the northwestern part of the state, forty-two miles northeast of Burlington and 163 miles southwest of Chicago. It is on the Chicago, Burlington & Quincy, and the Atchison, Topeka & Santa Fe railroads, and has interurban electric lines to Monmouth, Abingdon, Knoxville and East Galesburg. The area of the city is nine square miles. The population, which in 1910 was 22,089, was 24,276 in 1916, by Federal estimate.

Galesburg is an important educational center; it is the seat of Knox College (which see), a non-sectarian, coeducational school, Lombard College (Universalist) and Corpus Christi Lyceum, Saint Joseph's and Saint Mary's academies (Roman Catholic). The city has a Federal building, erected at a cost of $100,000; a Carnegie Library, state armory, Y. M. C. A. building, Galesburg Club, Masonic Temple, two hospitals, several fine churches and Standish and Lincoln parks.

The city is a market for the rich farming country surrounding it. It is an important division point on the Chicago, Burlington & Quincy Railroad, a road employing 2,500 people in its shops in the city and owning a passenger station and grounds worth $500,000. Among the industrial enterprises are a paving brick plant (producing annually 100 million [redacted] bricks), stockyards and manufactories *engines,* farm machinery and implements, overalls, mittens, typewriters, etc. The city has important wholesale interests.

A group of pioneers from New York settled here in 1836. They were led by Rev. George Washington Gale, a Presbyterian clergyman, who was desirous of organizing a school for the ministry in the West, a purpose realized in the founding of Knox College. Before the War of Secession, Galesburg was an important station of the "Underground Railroad" (which see). It was granted a city charter in 1857. One of the famous Lincoln-Douglas debates was held on the grounds of Knox College in 1858. F.R.H.

GALICIA, *ga lish'i a,* the largest of the Austrian crownlands, or provinces, is bounded on the north and east by Russia, on the south and southwest by Hungary, on the southeast by the Austrian province of Bukowina and on the west by Silesia. It occupies the northern slopes of the Carpathian Mountains, covering an area of about 30,300 square miles. Though the agricultural industry is not fully developed, Galicia has the largest area planted to potatoes in all Austria, and seventy-seven per cent of the people engage in farming for a living. Wheat, rye, barley, oats and garden vegetables are raised in large quantities, the supply of cereals being more than is needed for home consumption.

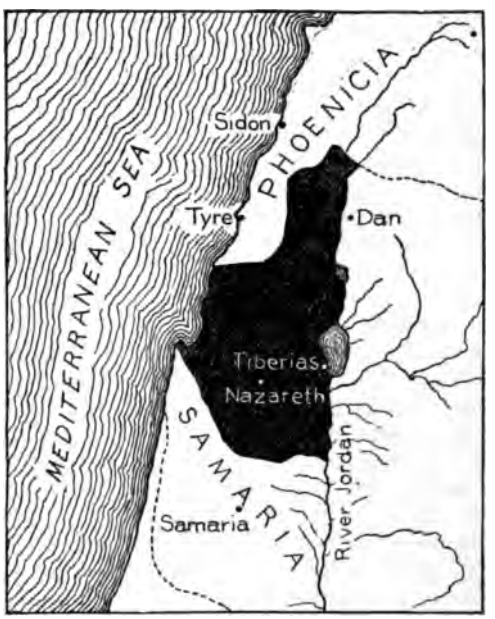
LOCATION OF GALICIA

Salt, coal and petroleum are the chief mineral products; some of the richest petroleum fields in Europe are found in the Carpathian range, and the rock-salt deposits of Wieliczka are famous. The country is drained by the Vistula, Dniester, Pruth, San, Dunajec and Bug Rivers and is noted for its numerous mineral springs. The climate is severe, the short summer being intensely hot and the cold of winter bitter and penetrating. Lemberg, the capital,

has a population of over 206,000; the next city in size is Cracow, with 154,000 inhabitants.

Galicia was a part of Poland (which see) until the first partition of the country, in 1772. It became a permanent possession of Austria at the close of the Napoleonic wars. During the War of the Nations (which see) it was the scene of terrible fighting between the Russian and Austro-German armies. Though overrun by the Russians and held by them until the spring of 1915, the crownland was reconquered by the opposing forces in their spectacular drive toward Warsaw. One of the outstanding features of this campaign was the assault on the fortified town of Przemysl, which surrendered to the Russians in March, 1915, and was recaptured by the Austro-German armies the following June. Lemberg also was the center of desperate fighting. Population of the crownland, 1912, estimated at 8,160,780.

GAL'ILEE, from the Hebrew word *galil,* meaning a *circle,* was at the beginning of the Christian Era the most northern division of



LOCATION OF GALILEE

Palestine, lying between the River Jordan on the east and the Mediterranean Sea on the west. It is now included in poverty-stricken, misgoverned Turkish Syria. It has a world-wide religious interest, which it will never lose, for Nazareth, Cana, Nain and others of its cities were the scenes of many important events during Christ's ministry on earth. The inhabitants of this locality, on account of their ignorance, peculiar dialect, and rather lax religious sentiments, were scorned by the ancient Jews, who, in derision, referred to the Christians as "Galileans." After the destruction of Jerusalem, however, the formerly despised region harbored many Jewish refugees, and became the center of a number of schools for the education of Rabbis.

Sea of Galilee, in Biblical history also called the LAKE OF GENNESARET and the SEA OF TIBERIAS, is an oval-shaped body of water in the north of Palestine. Through it flows the River Jordan. No other sea or lake in all history has held for so many hundreds of years the reverent attention of the Christian world, for it was intimately associated with the lives of Christ and His disciples. The northern part is the section associated with events in the Master's life, such as the walking on the water, the draft of fishes, the stilling of the tempest, and many other demonstrations of His divinity.

It is nineteen miles long by six miles broad, and is supposed to have been formed by volcanic forces. While it is fed by many warm and salty springs, its waters are clear, cool and refreshing. Once there were nine flourishing cities on its shores, and it was the center of an extensive fishing industry, but its vicinity is barren and practically deserted. Only two of the towns which flourished in Bible times yet survive—Magdala and Tiberias—but these are now almost in ruins.

GALILEO, *gal i le'o* (1564-1642), an Italian astronomer and mathematician, one of the world's original thinkers, whose investigations and discoveries have made him the creator of experimental science. He was the first to see clearly the unchangeable relation between cause and effect, and his service to the progress of learning is memorable and enduring. Galileo, the name which he bears by virtue of custom, is a shortened form of his real name, GALILEO GALILEI, which he did not like.

GALILEO

He was born at Pisa, and as a youth began to study medicine and the principles of Aris-

totle's philosophy in the university of that city. Not content to follow the beaten path of learning, at the age of eighteen he made an important discovery quite outside his regular course of study. The great lamp hanging from the roof of the cathedral at Pisa was one day accidentally set in motion, and as Galileo watched it swinging to and fro he was so impressed by the regularity of its movements that he conceived the idea of a simple pendulum used for the measurement of time. This discovery he turned to good account years later in the construction of a clock for astronomical purposes.

About the same time he abandoned the study of medicine for that of mathematics, a subject which opened up to him a new field of research that gave him untold delight. Though for lack of funds he was obliged to leave the university in 1585, he continued his mathematical studies in private, the first results of his investigations being his invention of a balance for weighing substances in water. By 1589 his achievements had won him such renown that he was appointed professor of mathematics in the University of Pisa, where he remained for two years. During this period he discovered the law that all falling bodies, regardless of their weight, travel through air with the same rate of speed. Galileo proved the truth of his theory by dropping balls of different weights from the leaning tower of Pisa, but his success only brought him into disfavor with the followers of Aristotle, whose faces were turned toward the past, and he found it advisable to resign his professorship in 1591.

The following year he accepted an invitation to lecture on mathematics in the University of Padua, and there he remained for eighteen years. His sojourn at Padua was a period of triumph and prosperity, and students from all parts of Europe came in vast numbers to hear his lectures. He was then at the height of his creative powers. In 1597 he invented the sector, a form of compass still used in geometrical drawing, and about the same time he constructed the first thermometer. Though he was not the actual inventor of the telescope, he was the first to make extended and practical use of it, and when in 1609 he began to sweep the starry heavens with an instrument of his own making, he opened up a wonderful era in modern astronomy.

He discovered that the moon was not a sphere shining by its own light, but that its surface was marked by valleys and mountains and that it gave out only the light which it reflected. Brushing aside the fables and superstitious tales concerning the nature of the Milky Way, he declared that it was a great field of myriad individual stars. In 1610 he made his crowning discovery of the four satellites of Jupiter, which he named the Medicean stars. In the same year he observed the peculiar form of Saturn, the rings of which were recognized several years later. He also detected the movable spots on the sun, inferring from their regular advance from east to west the rotation on its axis and the inclination of that axis to the plane of the ecliptic.

In 1610 Galileo was invited by his friend and patron, the Grand Duke of Tuscany, to establish himself at Florence as his official mathematician and philosopher, and soon after he made observations of the phases of Mercury, Venus and Mars. The following year he visited Rome, where he was received with high honors, but he was then just entering upon a period of discord and disappointment. His publication of a treatise on the sun's spots, in which he openly stated his belief in the theory of Copernicus (see COPERNICUS, NICHOLAS) that the earth moves around the sun, brought him into trouble with the Church authorities, and in 1632 the appearance of his great masterpiece, *A Dialogue Concerning the Two Great Systems of the World,* caused him to be summoned before the Holy Office (see INQUISITION).

After a long trial he was ordered to renounce his scientific theory and was sentenced to an indefinite term of imprisonment. The sentence was not strictly enforced, however, as he was given permission to reside first at Siena, and later at Florence, where he died. His interest in his labors continued to the end, even when, stricken with blindness, he could no longer look upon the wonders of the earth and sky. He was buried in the Cathedral of Santa Croce, at Florence, where a great monument has been erected in commemoration of his imperishable services to the cause of learning.

Related Subjects. The name of Galileo is forever associated with the following, and the reader is referred to the descriptive articles:

Falling Bodies	Pendulum
Gravity, Specific	Telescope

GALL, *gahl,* FRANZ JOSEPH (1758-1828), the founder of the system of phrenology, was born at Tiefenbrunn, Baden, Germany. He studied and practiced medicine in Vienna.

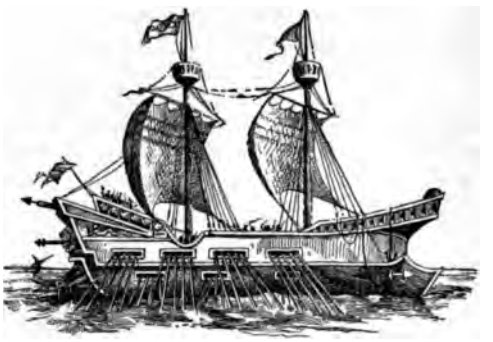
Having made an exhaustive study of the structure and functions of the brain, he became convinced that each of the various faculties of the mind had a special seat in the brain, and that the shapes of men's heads determined their mental and moral characteristics (see PHRENOLOGY). In 1796 he began a series of lectures at Vienna, but the ideas he advanced were so contrary to accepted theories concerning the mind that the Austrian government forbade his continuing his lectures in 1802. In 1807 Professor Gall went to Paris with his pupil and associate, Dr. Spurzheim. There he gained a successful practice and was also active in circulating his theories. Gall's system of phrenology at one time had wide acceptance, but modern research has shown that it is physiologically unsound.

GAL'LATIN, ALBERT (1761-1849), an American financier, statesman and ethnologist, was born in Geneva, Switzerland. He was graduated at Geneva Academy in 1779 and a year later came to America and was for a time teacher of French in Harvard College. In 1786 he removed to Fayette County, Pa., became a member of the state legislature, where he was active in opposition to the Federal excise law (see WHISKY INSURRECTION), and was elected to the United States Senate in 1793. However, he was declared ineligible to hold the latter office, it having been less than nine years since he became a naturalized citizen. He served in the House of Representatives from 1795 to 1801 and from that time until 1813 was Secretary of the Treasury, becoming such an eminent financier that a marked reduction was made in the national debt.

In negotiations which concluded with the Treaty of Ghent he rendered important service and was rewarded by appointment as minister to France, which post he held from 1816 to 1823. In 1826 he was sent to London as minister and on his return settled in New York and became interested in the problems of finance and education, and also took an active part in the founding of the University of New York. He was the first president of the Ethnological Society of America, which was founded through his efforts in 1842. He wrote several valuable essays on various phases of this subject. His published works include *Notes on the Semi-Civilized Nations of Mexico, Yucatan and Central America* and *The Indian Tribes East of the Rocky Mountains.*

GALL BLADDER, a small, pear-shaped pouch on the under side of the liver, in which bile is stored. It is about four inches long and two inches in diameter, and can hold about an ounce and a half of fluid. The stem, or neck, of the gall bladder connects with a tube (the *cystic duct*) which enters the *hepatic duct,* the two combining to form the *common bile duct.* When digestion takes place bile flows from the liver through the hepatic duct into the common duct and empties into the duodenum, the first division of the small intestine; during the interval between meals this fluid passes into the common bile duct, but is kept out of the intestine by a small muscle which guards the opening into the duodenum. It therefore flows backward into the cystic duct and from that tube into the gall bladder, where it remains until needed. If the bladder becomes inflamed by disease germs, small hard masses form inside of it. These are the *gall stones* that cause such severe attacks of pain when they pass through the bile duct into the intestine; in many cases they have to be removed by a surgical operation. See LIVER; BILE.

GALLEY, the ancient ship of the Mediterranean merchantmen, was a long, single or half-decked vessel with low free-board, propelled principally by oars but also having masts for sails. The term is generally descrip-



A GALLEY

tive of the later Roman and Grecian war-vessels of various types, the motive power of which was the oar, but it more particularly applies to the war craft of the Middle Ages, which survived in the Mediterranean navies after the adoption elsewhere of larger ships of war propelled entirely by sails. Ancient Greek vases show many illustrations of the *bireme,* or galley with two rows of oars, whose invention marked an important advance in naval construction, but it was the *trireme,* or galley with three rows of oars, which was the chief

hip of Greece during its period of glory. umber of oars varied, some vessels carwenty-five on either side, and others as as thirty-two, each being worked by men, originally by slaves or prisoners and later by condemned criminals. The eat naval battle in which galleys figured at of Lepanto, in 1571.

'LINULE, a family of water birds with similar to those of ducks, coots and American species are commonly called *ens,* the family name originating from tin word for hen. European species are as *water-oor-hens.* gh their not good, birds are shot for They are foot long ough not ooted are at swimfor their ender toes ished with ow mem- Like rails, have a frontal These

GALLINULE

re timid and during the daytime remain ed in tangles of reeds and grasses of nd meadow-brooks, but at twilight they e seen running gracefully over lily-pads, ing for their food of snails or water

e are two American species of gallinule. *urple* gallinule, olive-green above, with ad lower parts a beautiful purplish blue, r seen north of Texas, Tennessee and Carolina, but breeds and winters southnto South America. The *Florida* galseen from Ontario to Brazil, is browne above and greenish-black beneath, red bill. It lays its eight to eleven hich are buff, spotted with brown, in a dry grass and weeds. See RAIL.

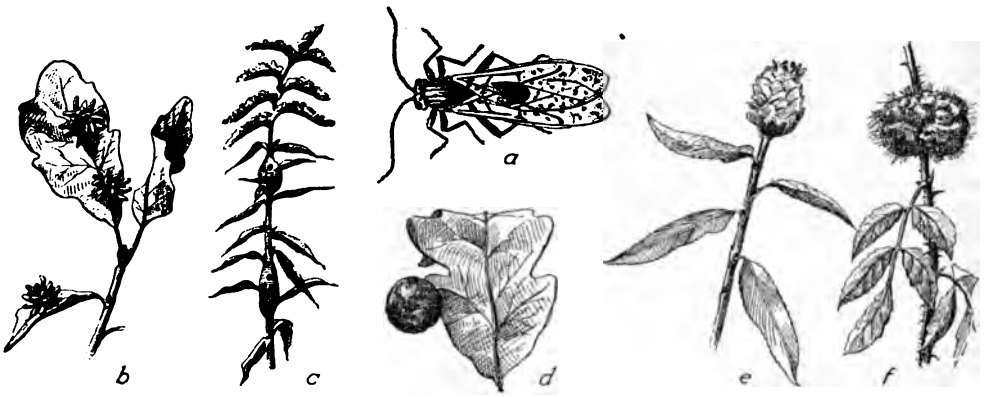
LIPOLI, *gal leep'o lee,* a long, narrow ountainous peninsula, also a town of ne name, in the Turkish province of ople. The peninsula separates the Dars from the Gulf of Saros, and during r of the Nations, in 1915, was the scene ific struggles between the Turks and Franco-British troops, in which the latter sought the capture of Constantinople. The town is at the northeastern extremity of the Dardanelles, 128 miles from Constantinople and ninety miles from Adrianople. It is not of any great commercial importance, and although once fortified and a center of industry, it is now dirty, dilapidated and neglected. It has two harbors, one of which has long been used as a station by the Turkish fleet.

The peninsula is extremely fertile, and corn, oil and wine are produced. The wine industry is carried on under difficulties, the Turkish government having imposed a tax of fifty-five per cent on all exports of wine, which led to the abandonment of many flourishing vineyards. During the Crimean War in 1854 allied armies of France and England landed on the peninsula of Gallipoli as protectors of the same Turkish power which in 1914 they determined to drive out of Europe. For map, see DARDANELLES. See, also, WAR OF THE NATIONS.

GALLIUM, *gal'i um,* a chemical element, discovered by spectrum analysis in 1875 by the French chemist Lecoq de Boisbaudran in the zinc ore found at Pierrefitte, in the Pyrenees Mountains. It is named after *Gallia,* the ancient name of France. Gallium is a rare metal, of grayish-white color, fairly hard, that may be hammered into thin plates which can be bent several times without breaking. It melts by the mere warmth of the hand into a silvery white liquid, its melting point being 86° F. Its general properties are similar to those of aluminum. Gallium combines with oxygen to form oxides, and with chlorine to form several kinds of chlorides. Its chemical symbol is *Ga.* See CHEMISTRY.

GALLON, *gal'un,* a liquid measure with a capacity of 231 cubic inches. It is divided into four liquid quarts, each quart being equal to two pints and each pint equivalent to four gills. The gallon is standardized in the United States, Canada and England. Any cylindrical body six inches in height and seven inches in diameter will contain exactly one gallon. In England an *imperial gallon* is also used; this measure has a capacity of 277.420 cubic inches. See WEIGHTS AND MEASURES.

GALLS, *gawlz,* unnatural growths on roots, stems, buds, leaves or flowers, plants or trees, produced by the presence of larvae (young) of insects, or in rarer instances by fungi, slime molds, algae, bacteria or worms. They vary in size from the merest swellings to fruitlike growths several inches in diameter. Some



VARIOUS FORMS OF GALLS AND A GALL FLY

(*a*) Gall fly; (*b*) galls on leaf of California white oak; (*c*) stem of goldenrod, showing spherical gall above, made by the larva of a fly, and below, a spindle-shaped gall made by the caterpillar of a moth; (*d*) oak apple; (*e*) willow cone gall; (*f*) mossy rose gall.

contain but one larva, others have several—in some cases a dozen—larvae. In appearance there is great variety, from those which are smooth and shining to rough and hairy varieties; from trumpet-shaped, rosette or starlike forms to ball or kidney shapes. Birds, squirrels and insects tear open these strange little homes to feed upon the larvae within, and to protect them from their ruthless enemies Nature has provided various interesting devices. Some secrete juices to trap intruding insects, others are protected by color, and still others are bitter with tannin.

Many gall-producing insects are extremely injurious to vegetation, as the Hessian fly, which costs the United States and Canada millions of dollars worth of wheat crops each year; or the destructive grape-vine phylloxera, or the clover-seed midge. The small, dark, four-winged gall-fly, however, is of some value, as it deposits its eggs in the leaves and twigs of various plants and trees, and when these are deposited in oaks the familiar and valuable spongy white, green or blue oak apples appear. From them are obtained tannin for leather tanning; they are also made into ink and dyes and are frequently used in medicine. The galls of commerce are gathered chiefly by peasants in Aleppo, Italy, formerly the center of that trade, and in Persia, Cyprus, Asia Minor and Syria. Although oak apples are abundant throughout America, the gathering would be too costly. The pioneers used them for ink and dyeing, and some of the oldest American documents show the bright, practically permanent ink of oak galls.

Related Subjects. The reader is referred to the following articles in these volumes:

Algae	Insects
Bacteria and Bacteriology	Phylloxera
Fungi	Slime Molds

GALS'WORTHY, JOHN (1867-), one of the foremost of twentieth century English novelists and dramatists, noted for his keen studies of social problems. Galsworthy is usually regarded as a writer with a purpose; nearly all the work of his mature years deals with some evil or injustice against which he protests. Thus his play *Justice* is a bitter protest against the practice of placing convicts in solitary confinement. Aside from its success as a play it achieved the desired effect in that it called public attention to the horrible results of solitary confinement and actually induced the British government to abolish this form of punishment. Galsworthy's efforts to secure reforms, however, do not mean that he has sacrificed artistic workmanship to propaganda; his novels and plays, on the contrary, are artistically successful, and it is likely that his work would not be so successful in securing reform if it were not also literature of permanent value.

JOHN GALSWORTHY

It is as a dramatist that Galsworthy is perhaps best known, although his first piece of writing was a novel, *Jocelyn,* published in 1898.

Villa Rubein and *A Man of Devon*, his next novels, like *Jocelyn*, received little notice from the public, but after 1904 his talent was recognised. In that year appeared *The Island Pharisees*, a study of English life. In rapid succession thereafter he wrote *A Man of Property*, satirising the ways of the great capitalists, *The Country House*, which deals with the life of the landed gentry, and *Fraternity*, which is largely a study of class feeling. His later books include *The Patricians*, the *Inn of Tranquillity* and *The Dark Flower*, a morbid love-story.

His plays, nearly all of which have been produced, include *Joy*, *Strife*, *The Silver Box*, *The Pigeon*, *The Eldest Son*, *The Fugitive*, *The Mob*, and *The Little Dream*, the last-named a poetic, fantastic little story which is very different from most of his tragic plays.

GALT, Sir Alexander Tilloch (1817-1893), a Canadian financier and statesman, who was responsible for the introduction of the decimal system of currency into Canada. He was born in London, England, but when he was eighteen years of age he was sent to Canada in the employ of the Canada Land Company, of which his father was superintendent. He remained in the service of the company for twenty years, and during the last twelve years of the period was its chief commissioner. He was at one time also interested in the promotion of railways and was a partner in the firm which constructed the Grand Trunk Railway from Toronto westward to Sarnia.

SIR ALEXANDER GALT

Galt entered political life in 1849 as a member of the Canada assembly. Though a Liberal, he opposed the Rebellion Losses Bill, the chief measure of his party. He retired from the assembly before the end of the year, but reëntered it in 1853, and for twenty years thereafter was the leading spokesman for the English Protestants of Quebec. A man of independent views, he was never willing to give his unqualified adherence to either political party, and for that reason never had a large following. Yet so great was his reputation that in 1858 he was called on to form a ministry, a task which he declined. From 1858 to 1862 and again from 1864 to 1866, as inspector-general of finance, he did much to reduce the chaotic finances of Canada to order. In 1859 he secured the passage of a tariff act which was the beginning of a system of protection for Canadian manufactures, and in 1866 the decimal style of currency was adopted through his efforts.

Galt was one of the men whose influence led to the coalition ministry of 1864-1867 and eventually to Confederation. He became Minister of Finance in the first Dominion Ministry, formed by Sir John A. Macdonald, but resigned after a few months. In 1877 he rendered brilliant service as Canadian representative on the Anglo-American Fisheries Commission which met at Halifax. He was the first High Commissioner to Great Britain, from 1880 to 1883, being succeeded by Sir Charles Tupper. The last ten years of his life were spent in retirement. G.H.L.

GALT, a town in Waterloo County, Ontario, in the southwestern part of the province, situated on both banks of the Grand River, about fifty-five miles from its entrance into Lake Erie. Hamilton is twenty-five miles southeast and Toronto is fifty-seven miles northeast. Railway transportation is provided by the Grand Trunk, the Canadian Pacific and the Lake Erie & Northern railroads, and electric lines connect with Kitchener, Paris, Waterloo and Brantford. The first settlement was made in 1816, but the city was not incorporated until 1915; it was named in honor of John Galt, a Scotch author, father of Sir A. T. Galt. The population is chiefly Scotch, with a small mixture of English, Dutch and Germans; in 1911 it was 10,299; in 1916, estimated, 11,000.

The immediate surroundings of the city are well-wooded, and with the river, which is here spanned by the several bridges, present some picturesque scenery. Of the city's recreation grounds, Victoria Park is the largest and most attractive. Stone is largely used in the construction of the buildings, the most noteworthy being the post office and custom house, the city hall, the public library and several churches. Galt is located in a rich agricultural district, which also produces a good supply of lumber, limestone and sand. Manufactures are represented chiefly by iron and brass foundries, shoe factories and sawmills. J.McC.

GALTON, *gawl'ton*, Sir Francis (1822-1911), an English scientist and author who is chiefly noted for his important researches in heredity,

biology and anthropology. He was educated at Birmingham and Trinity College, Cambridge. After spending about two years in the Sudan, studying native types, he started on a journey of exploration through Damaraland and the Ovampo country in Southwest Africa. His published account of his travels brought him the gold medal of the Royal Geographical Society. Becoming interested in meteorology, Galton suggested many important theories and published extensive weather charts and articles on anti-cyclones.

On the subject of heredity he held advanced views and boldly advocated the checking of the birth rate of the unfit by suitable selection of parents. He was the first to use the term *eugenics,* which has since been universally adopted. Galton was singularly versatile, quick, yet thorough, and an enthusiastic worker. His notable publications are *Hereditary Genius —Its Laws and Consequences; Inquiries into Human Faculty and its Development* and *Natural Inheritance.* Honorary degrees were bestowed on him by Oxford and Cambridge universities, and in 1909 he received knighthood. See ANTHROPOLOGY; HEREDITY; EUGENICS.

GALVANI, *gahl vah'ne,* LUIGI (1737-1798), an Italian physiologist and anatomist, the discoverer of galvanism, so named in his honor. He was born at Bologna, studied medicine there, and in 1762 began to practice. In 1765 he became lecturer on anatomy at the University of Bologna, which position he held until the year before his death, when he was deprived of his professorship because of his refusal to take the oath of allegiance to the Cisalpine Republic. Just before his death he was reinstated.

His celebrated discoveries relative to the effect of electricity upon animal muscles began with the observation of the accidental contact of the dissected legs of a frog with a scalpel which was itself in contact with an electric machine. The results of his experiments were published in 1791. See ELECTRIC BATTERY; GALVANISM.

GALVAN'IC BATTERY, the old name for electric battery. It was formerly supposed that the electric current produced by chemical action was different from that produced by friction, and the name *galvanic* was given to electric batteries in honor of Luigi Galvani (which see), the discoverer of the fact that an electric current could be produced by chemical action. When it was learned that the current generated by a battery was of the same nature as that generated by friction, the term was discarded. See ELECTRIC BATTERY; GALVANISM.

GAL'VANISM, a term formerly applied to an electric current and its effects when the current is produced by an electric battery. Originally the term was used to distinguish electricity produced by an electric battery from that produced by an electrical machine, but after it was discovered that the electricity of an electric battery and that of an electrical machine are one and the same, *galvanism* fell into disuse. The name is derived from that of an Italian scientist, Luigi Galvani (which see). See ELECTRICITY; ELECTRIC BATTERY.

GAL'VANIZED IRON, a name commonly applied to thin sheets of iron that have been coated with zinc as a protection against rust. The process is not in any way galvanic, but consists of first cleaning the iron in a warm solution of sulphuric or hydrochloric acid, and then immersing it in a bath of molten zinc and sal ammoniac. As the zinc cools it deposits crystals on the surface of the iron, giving it a mottled appearance. Galvanized iron is extensively used in corrugated and plain sheets for cisterns, roofs and many buildings. In parts of South Africa it is in such general use for dwellings that whole villages and towns are composed of houses made of this material, lined with match boarding. In Western Canada it is used for roofing, but it is unsuitable there for any other part of houses, as it affords little protection against cold. Ship's bolts, nails, screws, wire netting, fencing and telegraph wires are among the articles usually galvanized. During the South African War large cylinders of galvanized iron filled with earth and stone were extensively used for blockhouses and minor fortifications.

GALVANOMETER

GALVANOM'ETER, a delicately-adjusted instrument used to detect and measure the strength of an electric current. It consists of a coil of insulated wire surrounding a magnetic needle, hung so that it is made to move by the slightest electric current sent

through the coil. Movement occurs over the face of a dial marked off in degrees, the strength of the current being indicated by the distance over which the needle passes. In the galvanometer invented by Lord Kelvin a ray of light is reflected upon a screen from a mirror attached to the needle. The slightest movement of the needle is indicated by a movement of the light ray. Currents so weak that they would not be noticed even if passed through the human body can in this way be detected and accurately measured.

GAL'VESTON, TEX., is the greatest cotton port in the world, and it ranks next to New York and New Orleans among the cities of the United States in the value of exports and imports. It is the county seat of Galveston County, and is situated on the east end of Galveston Island at the mouth of Galveston Bay, an inlet of the Gulf of Mexico, fifty-three miles southeast of Houston and 300 miles (direct) southwest of New Orleans. Railway facilities are provided by the Gulf, Colorado & Santa Fe; the International & Great Northern; the Missouri, Kansas & Texas; the Galveston, Houston & Henderson, and the Galveston, Houston & San Antonio railroads; the city also has the Galveston-Houston electric railway. Besides steamer lines which have regular sailings to New York, there are regular communications with European, Asiatic and North and South American ports. The city is connected with the Texas mainland at Virginia Point by a reënforced concrete causeway two miles long, which spans Galveston Bay. Passage is afforded ocean steamers by a lift bridge, the largest of its kind in the world. All nationalities are represented in its population, which increased from 36,981 in 1910 to 41,863 in 1916; the latter is an estimate based on the increase from 1890 to 1900. The area, which includes Pelican Island, is nearly fifteen square miles.

Boulevards and Buildings. The residential part of Galveston suggests a typical Southern city, with its stately mansions, many of them white, luxuriant gardens, and streets lined with palms, oaks, oleanders, magnolias and jasmine. Menard Park, Sidney Sherman Park and Central Park add to the general beauty of the city. Between the sea-wall and the sea extends the beach, thirty miles long and considered the finest in the world, the bathing, fishing and boating facilities being unsurpassed. This beach is also an automobile course.

Galveston is a popular health resort in the [illegible]west, attracting great numbers of visitors annually. It has many notable buildings, among which are the old post office, which has been remodeled; the new Federal building; the Federal Quarantine Station; the Rosenberg Library, costing $250,000 and having an endowment of $400,000; the city hall with its beautiful park; John Sealy Hospital, which operates in connection with the state medical college; American National Insurance building; and the Hotel Galvez, built in 1912 at a cost of $1,000,000, raised by public subscription. The last-named, with the eleven other hotels, is equipped to uphold Galveston's reputation for Southern hospitality, many thousands of visitors being easily accommodated over night. There are some fine bank and business buildings and homes for orphans and homeless women.

Educational Institutions and Churches. Besides its public school system, including two high schools, the city has the state medical college, a department of the University of Texas, Saint Mary's University, Ursuline Convent, a Jesuit college, a Dominican convent, Sacred Heart Academy, twelve sectarian schools and business schools. There are thirty-one churches for white and twelve for colored people.

Commerce and Industry. Galveston is the leading commercial city of Texas. Its wharf and terminal facilities have few equals in the United States, being exceeded only in size. The harbor has been improved at a cost to the United States government of $15,000,000; the granite jetties twelve miles long alone cost $8,000,000. Cotton ranks first among the exports, which also include wool, hides, grain, flour, oil-cake, oil-meal, fish-oil, lumber, provisions and fruit. The most important industrial enterprises are the Galveston Wharf Company, the cotton compress and concentrating plants and flour, bagging and rope mills. There are four export grain elevators, and several large wholesale houses.

History. In 1836 Colonel Michael B. Menard organized the Galveston City Company and purchased the site of modern Galveston from the Republic of Texas. The city was incorporated in 1839 and named in honor of Count Bernardo de Galvez, Spanish viceroy of Mexico. During the War of Secession it was captured by the Federal troops and retaken in 1863 by the Confederates, who held it until the close of the war. For many years to come the inhabitants will remember September 8, 1900, when the city was visited by the most

appalling disaster from natural causes in the history of the North-American continent. The city was flooded to a depth of from four to sixteen feet by a West Indian hurricane, which caused a loss of 8,000 lives and a destruction of property amounting to $20,000,000.

To prevent another such catastrophe, three tremendous engineering feats have been accomplished—the erection of the sea-wall, the raising of the city grade and the building of a causeway. The sea-wall is a concrete steel-reënforced battlement 17,593 feet long, sixteen

PATH OF THE HURRICANE
The figures indicate days of the month and show the rate of speed of the wind, which reached its greatest velocity at Galveston.

feet wide at the base and seventeen feet high. In raising the grade the city was lifted to a height of nineteen feet above its former level, two feet higher than the sea-wall, and during the operations, the city may be said to have walked on stilts, as houses, walks and car lines were propped up while thousands of cubic yards of sand were deposited from the Gulf of Mexico. To bring order out of chaos, several citizens at that time formed a new plan of government, and in 1901 Galveston presented to the world what is now known as the commission form of government, which has been adopted widely throughout the United States, Canada and Europe. H.H.H.

GAMA, *gah'mah,* VASCO DA (1460?-1524), a Portuguese navigator, the first to sail around the Cape of Good Hope, and the discoverer of the sea route to India. He was descended from a noble family and at an early age became known as a fearless mariner. He was selected by the king of Portugal to command an expedition to find the way to India. He sailed July 8, 1497 and after visiting Calicut, returned to Portugal with reports of the boundless wealth of India. The king richly rewarded him with rank of nobility, a pension and great commercial privileges. He was named Admiral of the Indies and made a second successful voyage. In 1524 he was appointed viceroy of India and was sent out to remedy the ill effects of the misrule of the king's representatives. The same year he died at Cochin. His body was later removed to Portugal and buried with honors in Lisbon.

GAMA, *gah'ma,* **GRASS,** or **SESAME,** *ses' a me,* **GRASS,** a fodder grass cultivated in the Southwestern United States, Mexico and parts of Europe, but particularly adapted to the climate of Australia. The name *gama* is from that of a Spaniard who first attempted to cultivate it in Mexico. This grass is drouth-enduring, and is quickly killed by frost. From stout rootstocks its coarse, pithy, branching stems grow to a height of nine or ten feet. Its leaves, about six feet long, resemble those of Indian corn. In midsummer it bears spikes of feathery, dark purple flowers, topped with long, orange-colored anthers.

GAMA'LIEL, a Jewish doctor of the law and member of the Sanhedrin who showed his good judgment and common sense when he urged his colleagues not to persecute Peter and the other Apostles for preaching Christ to the people (*Acts* V, 34). He was the rabbi, or teacher, who taught Saint Paul in his youth and was held in the highest respect among his countrymen. For that reason they were guided by his reasoning when he said that if the Apostles' work were simply man's, it would finally come to nothing, even if they took no measures against it, while if it were of God, they could not overthrow it, for they would be fighting God. He is said to have been president of the Sanhedrin for several years, but the report that he became a Christian is without proof.

GAMBETTA, *gam bet'a,* LEON (1838-1882), a French statesman noted for his bitter opposition to monarchical government. As a lawyer he met with great success in Paris, chiefly in defending political prisoners. In 1869 he was elected to the Chamber of Deputies by Paris and Marseilles, and his republican views immediately attracted attention. He strongly opposed the policy which resulted in the Franco-German War in 1870, and led bitter attacks against the empire. He escaped from

Paris in a balloon during the siege, and established what amounted to a dictatorship at Tours. Calling on the nation to rise in a mass to overwhelm the invaders, he conducted a fierce resistance, with a determination to fight to the end. He accused Marshal Bazaine of an act of treason in surrendering Metz, and was active in securing his trial after the war. After peace was made he held office in several Ministries and became Premier in November, 1881. Resigning in 1882, he continued to exert his influence through his paper, the *Republique Française,* one of the most brilliant journals of the time. His death was hastened by a wound in the hand caused by the accidental discharge of a pistol. See FRANCO-GERMAN WAR.

LEON GAMBETTA

GAM'BIA, the most northerly of the British colonies on the west coast of Africa, covering an area of about 4,000 square miles in a long triangle, on both sides of the River Gambia. The climate is more healthful than elsewhere on the west coast, for there the malaria-carrying mosquito has been practically exterminated. The Gambia is navigable for the whole extent of the colony, and affords excellent means of transportation for internal produce. Rice, maize, cotton and ground nuts are raised for local use, and rubber, beeswax and palm oil are extensively exported. The rivers and creeks are inhabited by hippopotami and crocodiles, and lions, leopards, monkeys, wild boars and many kinds of deer are found in the forests and plains. The capital is Bathurst, on the island of Saint Mary, at the mouth of the Gambia. Most of the inhabitants are negroes, industrious, thrifty and skilful agriculturists. Population, estimated at about 163,000.

Gambia River, one of the most important rivers on the west coast of Africa, and the only one that is navigable at all times of the year for 200 miles from the sea. It rises only 150 miles inland, but winds and twists over a course of 1,000 miles before emptying its waters into the Atlantic Ocean. Mungo Park, the explorer, started his two journeys into the interior from this river in 1795 and 1805. The source was discovered in 1818.

GAMBOGE, *gam bohj'*, or **CAMBOGE,** a resinous gum derived from the gamboge tree, a native of Cambodia, Ceylon, Siam and other Far Eastern countries. The tree grows to a height of forty or fifty feet, has oval leaves like those of the laurel, and square-shaped, four-seeded edible fruit. The gamboge is obtained by making incisions in the bark of a tree in the same way that maple trees are tapped. A bamboo tube is placed so that the juice is carried off and received in cocoanut shells or other receptacles. The juice hardens on exposure to the air, becoming a dirty orange on the outside and brilliant yellow inside. It is sold commercially in hollow rolls, sticks and shapeless lumps.

Gamboge is extensively used by artists in mixing water colors, for staining wood and as a lacquer for brass. In medicine it is occasionally employed as a cathartic, but its action is harsh, causing severe griping. It is said to be effective in minute doses in cases of dropsy and apoplexy when taken in conjunction with a sedative. American gamboge, which is used for the same purposes, is obtained from a similar tree which is native to Mexico. It is somewhat inferior to the imported variety.

GAME, the general name for animals which are hunted, from truly wild beasts, such as tigers and bears, to small, helpless creatures like the rabbits and fowls.

Game Laws. There are two distinct types of game regulations, those intended to make hunting the privilege of aristocracy, and those to prevent the wanton destruction of game and the possible extermination of a species of animal life. The first are characteristic of European countries, the second, of America. In Scotland and Ireland none are permitted to hunt but the possessors of estates of a certain size or value, and a similar restriction was in effect in England until 1881. Such provisions are a survival of feudalism, of the days in which *poaching,* or illegal hunting, was an offense sometimes punished by death.

Each of the American states and Canadian provinces has its own game laws. Most of them forbid shooting except during a short period of each year known as the *open season,* and restrict the number of animals which each hunter may kill, have in his possession, or ship out of the state. Any person may secure a copy of his state or provincial game laws by addressing the game warden, at the capital. In Canada, a law of the Dominion places a rigid limit upon the export of game.

Private Game Preserves. Because of the existence of many private estates which have survived from the Middle Ages, there are in Europe large numbers of areas where game is preserved that the aristocracy may indulge in the traditional sport of hunting. In America private preserves are less common. That of the Roberval Club, in the Laurentian Mountains north of the city of Quebec, contains more than five hundred square miles of forest, and there are a number of others belonging to sportsmen in the United States and Canada which contain several thousand acres. Other private game preserves are maintained by lovers of wild life who wish to prevent the extinction of buffalo, waterfowl and other beasts and birds that are prey for the hunter, unless protected.

Game Reservations. National, state and provincial governments in America have taken steps to preserve the native *fauna* of the continent by setting aside large tracts where the animals may live unmolested. Among these are the national parks, the largest of which are the Jasper Park in Alberta, containing 5,450 square miles; the Rocky Mountains Park, in the same province, with an area of 4,320 square miles; and Yellowstone Park, in the United States, 3,348 square miles in extent. The Laurentides Park of the province of Quebec is slightly larger than the Yellowstone. Thousands of wild animals make their homes in these parks, among them elk and buffalo, deer and antelope, mountain sheep, moose, bear and beaver. The largest game reservations in the world are those of the British government in Central Africa, where the rhinoceros, the hippopotamus and other strange beasts are native. See, also, BIRD, subtitle *Government Protection of Birds.* C.H.H.

Consult Hornaday's *Our Vanishing Wild Life; Circular 87,* United States Department of Agriculture. "National Reservations for the Protection of Wild Life."

GAMES AND PLAYS. Time was, not more than a few generations ago, when play was looked upon as an almost unmixed evil—necessary at times, to be sure, but by no means to be encouraged. Children wanted to play, and most parents were not hard-hearted enough to keep them from it entirely, though looking upon it as a waste of good time which might have been far better employed in some useful occupation. Even to-day elderly persons are found who look back to their childhood almost with bitterness because of the dull work-a-day lives they were forced to lead, unrelieved by the joyous sports natural to youth. The son of a preacher of the old school declares that whenever in his boyhood he began the most innocent of plays his father called him into the house to sing, "My God, my heart I bring to Thee." This father did not understand the value of play.

At present there is danger of the pendulum's swinging too far in the other direction and of the child's having too much play, but the wise teacher or parent can regulate that matter easily. Of course, with a child, the difference between play and work is one of mental attitude—the play is often far more strenuous than are his simple tasks, and calls for more concentration, but he does it joyously because he has the play attitude toward it.

Value in Play. Why is it that the educational world, blind for so long to that particular phase of children's activities, has now come to look upon play as so important that special provision is made for it in the course of studies? And why are large cities providing public playgrounds and attendants who can teach the children interesting and healthful games? The explanation of these changes in policy is in the recognition of the truth of Froebel's statement that "Play is not trivial; it is serious and fraught with deep meaning." "If this be true," the teachers and the children's welfare committees have argued, "if play really is a serious matter, then it is worth the serious attention of grown people."

That this is true no one who has watched children at their play can doubt. In no way can a child express himself more fully than in his play. His ingenuity, his memory, his power of concentration, all of these are brought into service, while as a means of developing the social spirit and preventing undue insistence on self, competitive games are unrivaled.

Then, too, play actually helps work. Little children sit in school until their minds as well as their bodies have become tired and stiff, but a few moments of play will send them back to their tasks relaxed and refreshed, and the teacher has not nearly so much difficulty in holding their attention as before.

Aim of Play. When children play by themselves, undirected, they have no conscious aim but to "have fun." This article, however, is intended to give aid not only to children who are on the everlasting quest for "something to do," but to teachers and others who have charge of children during their play periods. The unconscious play of children is full of suggestion, and teachers must endeavor to keep themselves in the background. To know what plays or games are best and most attractive to children, careful students of childhood have devoted their best efforts to the study of those games children most delight in. To fulfil the purposes of such play-directors, games must have certain characteristics and must help the children in certain ways. Taken all together, games and plays should be:

(1) *Hygienic,* bettering in some way the circulation or respiration, and so improving the general health.

(2) *Corrective,* tending to straighten little backs that are in danger of becoming curved with too much bending over desks, to give a correct poise to a drooping head, or in some other way to correct defects in posture.

(3) *Educative,* training muscles, nerves or brain to act quickly and accurately.

(4) *Recreative,* having the one purpose of relaxing and brightening the minds of the children and so fitting them to go on with their work.

Naturally, every game cannot excel in all these points, and care should be taken to vary the games so that no one purpose may be too long insisted upon. Very seldom is it necessary for the pupil to know what the teacher is attempting to accomplish by a certain game; indeed, such knowledge often defeats the purpose. For instance, if the teacher says, "Hold up your heads and throw back your shoulders; this game is to keep you from becoming stoop-shouldered," she is certain to have but a feeble response. But if at the outset she declares that they are now to play a soldier game, and calls out, "Soldiers, Attention!" heads will be held up and shoulders straightened half unconsciously.

Games in the Schoolroom. First and foremost, the teacher should enter as far as possible into the spirit of the game, not only because she herself needs the relaxation, but because the children enjoy far more a game which they feel is interesting enough to hold "teacher's" attention, too. So far as possible the children should be allowed to choose the games, as they will then enter into them far more spontaneously.

As to methods of introducing games, the teacher needs to remember but a few simple suggestions. A game cannot be explained and played successfully at the same time, and full explanations should therefore be made before the playing starts. The explanation should be as short and simple as possible, that the eagerness of the children may not be dulled. In the playing of competitive games each side should be encouraged to do its best to win; nothing can teach children the difficult art of being good losers and the almost more difficult one of being good winners except actual participation in games. "Honor" should be made a strong point, too, and the rules of the game insisted upon. It is a well established fact that the boy who would rather lose a game than do anything in the least dishonest to win it will some day be the business man whom his associates can trust. It should be made clear that the same rules hold good for girls.

Games for Young Children

In the Schoolroom

Follow the Leader. A child who is not afraid to "start things" is chosen as the leader, and the children fall in line behind him. In and out through the aisles and around the room he leads them, making certain motions which every child must imitate. He may run or skip, step high as if he were stepping over hurdles, clap his hands, wave his arms or hold them above his head—anything which his fertile brain may devise. This is a brisk game and freshens the children up wonderfully. During this and all other games of action the teacher should throw open the windows.

Playing Train. Each child is given the name of some part of a train. Thus one may be

the wheels, one the bell, one the conductor, one the engine, and so on. They take their places in a row and run their "express train" through the aisles and around the room, each child acting out his part so far as possible. When the teacher

FOLLOW THE LEADER
(Details of the game are on page 2374.)

calls out that the train is at a station the children take their seats and another group becomes the train. Very little children find much diversion in this and it is a good recreative game.

Do As I Do. A "teacher" is chosen from among the pupils and takes his place in front of the others, who stand either at their desks or in a semicircle. All except the leader then sing:

"Now, John, will you teach us
A new game to play?
We'll watch you and try to
Do just as you say."

The "teacher" performs some simple exercise in which he wishes the others to follow him, as raising his arms above his head and bending to touch the floor with the fingertips, running in place, or rowing, and the others do as he does.

I Saw. A child in each row is called on to tell of some action he has seen: "I saw a dog running," he says, or, "I saw a frog jumping," or, "I saw a swallow flying;" and all the children in the row imitate the action, while following the leader about the room. In any such play as this care must be taken to select occasionally the bashful children, who will not speak out unless they are expressly called upon.

Catch the Squirrel. This game is certain to interest the children, but it gives only one or two exercise at a time and should, therefore, not be used as often as those games which permit all the pupils to be in action at the same time. Each child blinds his eyes and lays his head upon his desk, but keeps one hand open that the child who has been chosen as "squirrel" may drop a nut into it. The child who receives the nut springs up instantly and runs on tiptoe after the squirrel, trying to catch him before he can reach his seat. If he fails to catch him, he becomes squirrel in turn.

In the Home

Games that are to be played in the home are of necessity quieter and call for fewer players than do the schoolroom games, but some of them at least should have some action. On a stormy day when children must remain within doors and they become restless in consequence, a game or two of action, played in a room with open windows, will "tame them down" wonderfully.

Ring-Toss. This is a game which has real educational value, in that it develops precision of movement and a ready response of muscles to mind. A circular stick about a foot in length—a portion of a broom handle will answer excellently—is made to stand upright by driving it tightly into a hole which has been bored in a board about a foot square and five or six rings are provided, of such size that they will slip easily over the stick. The players then take their station a few feet away and attempt to toss the rings over the stick, each player throwing all the rings and keeping count of his successful tosses. Gradually the distance between the player and the stick is increased.

The Garden Gate. All the players except one join hands and dance in circle about the one who has been chosen as "it," who meanwhile sings to them to the tune of "Here we go round the mulberry bush":

Open wide the garden gate, the garden gate, the garden gate,
Open wide the garden gate and let me through.

They then dance in the opposite direction, singing all together:

Get the key of the garden gate, the garden gate, the garden gate,
Get the key of the garden gate and open and let yourself through.

The one inside the circle then pretends to weep and sings in reply:

I've lost the key of the garden gate, the garden gate, the garden gate,
I've lost the key of the garden gate and cannot let myself through.

Still dancing round and round her the others sing:

You may stop all night within the gate, within the gate, within the gate,
You may stop all night within the gate, unless you have strength to break through.

The prisoner then rushes suddenly to the ring and throws her whole weight upon the clasped hands of two of the children, trying to break through; and if she succeeds another player takes her place in the ring.

My Lord's Toilet. Each child in the party is given the name of some article of a gentleman's dress and then all take their seats but one, for whom no chair is provided. This one, called the Valet, takes his stand in front of the rest and calls rapidly for the different articles. "My lord's up and wants his collar," he cries, when the person who represents the collar must jump up quickly, call out "Collar," and sit down again. If any player does not respond instantly he must pay a forfeit. Occasionally the Valet exclaims, "My lord's up and wants his whole toilet," when all the players must jump up and change chairs, the Valet scrambling for one also. The one who is left standing becomes Valet in turn.

Out-of-Doors

Of course, the ideal playing ground is out-of-doors; not only is the air purer, but the children are rid of the cramped feeling which

is inseparable from indoor playing, and can really stretch their muscles. Certain of the games described above can easily be played out-of-doors and some of those listed below

DROP THE HANDKERCHIEF

may be used indoors in stormy weather, if there is a considerable open space. Especially is this true of the bean-bag games.

Games with Bean Bags. A set of bean bags should be in every schoolroom and the children will usually be glad to make them. These bags should be of some strong material, bright-colored if possible, should measure about five by five inches and should be about half full of beans.

For the simplest of the bean-bag games the children form a circle about one of their number who is the "teacher." He tosses the bag to the others either in rotation all around the ring or out of turn with the object of catching some player napping. The one thus caught becomes "teacher" in turn. Then, to vary the game, the teacher may throw the bag into the air and call the name of some child who must spring forward and catch it before it touches the ground.

In another bean-bag game the children stand in two rows, facing each other. The first child in one row tosses the bag to the second in the other row, who tosses it to the third in the first row, the bag keeping its zigzag course until it reaches the end of one row, when it is tossed directly across and then back again in the same zigzag manner. Thus the children who did not have a chance to catch the bag as it passed down the line have their turn on its return journey.

Cat and Mouse. In this game the players join hands to form a circle, and stand about an arm's length apart. One player, the cat, stands outside the circle, while the mouse, the one to be caught, stands inside. Those who form the circle may raise their arms to allow cat or mouse to pass in and out of the circle, or they may hinder them by lowering their arms. When the mouse is caught other players are chosen.

Pasture. The players stand in a circle, three [illegible] yards apart, and a ball or bean bag is [illegible]idly from one to another. Each one must remain as though turned to [illegible]ttitude in which he was when he failed, and the last to miss wins the game. He tosses the ball into the air and catches it ten times while the others retain their positions.

Drop the Handkerchief. This is always a favorite with the children and it is a good game for a large party. All the players save one form in a circle, the one taking his place outside with a knotted handkerchief in his hand. As he runs about the circle he sings:

Itisket, Itasket, a green and yellow basket,
I sent a letter to my love and on the way I dropped it, I dropped it,
A little boy picked it up and put it in his pocket.

Quietly he drops the handkerchief and runs on, trying to get around the circle and tag the player behind whom he dropped it before it has been picked up. If the player discovers it, however, he picks it up and runs with it, trying to tag the one who dropped it before he reaches the vacant place.

London Bridge. Two children join their raised hands to form a "bridge" under which the others must pass in line, the two singing:

London bridge is falling down, falling down, falling down.
London bridge is falling down, my fair lady.

With the last word the "bridge" is dropped over one player who is led aside to the tune of—

Off to prison you must go, you must go, you must go,
Off to prison you must go, my fair lady.

The prisoner is then asked to choose between two objects, one of which has been selected by each of the two "bridge-tenders," and takes her stand

LONDON BRIDGE

behind the one whose object she has chosen. The game goes on until all have been imprisoned, the side which has secured the most players winning the game.

Moon and Morning Stars. This is a game to be played in the sunshine. The player who takes the part of the moon stands in the shadow of the schoolhouse, tree or other object, and is not permitted to go into the sunshine. The other players, the morning stars, dance into the shadow near the moon and call:

O the Moon and the Morning Stars!
O the Moon and the Morning Stars!
Who will step—Oh,
Within the shadow?

The moon then attempts to tag the stars. Anyone caught may be kept with her or change places with her.

Frog in the Middle. This game may be played by any number. One is chosen to be the frog and must sit with crossed feet in the center. The other players, who stand in a circle about him, keep repeating, "Frog in the middle can't catch me!" They dance back and forth in front of the frog, seeing how near they can go without being tagged. The frog tries to tag them, but must not change his position. Anyone tagged must be frog.

Other Games. Any crowd of children is certain to have its favorite games, in addition to those listed above. One or more can always be found who will be only too eager to lead the rest in Pussy Wants a Corner; Farmer in the Dell; King William Was King George's Son; Here We Go Round the Mulberry Bush; Oats, Peas, Beans and Barley, O; I Spy; and any of the various kinds of tag. It is difficult for an older person to understand the charm which such a game as The Farmer in the Dell, for instance, holds for children. True, there is little action, but the children find very attractive the circling about in time to the meaningless chant while the chance of being "taken" next keeps each little player keyed up and interested. The one directing the play should see that all are given turns.

Games for Older Children

As children get older a change is noticeable in the play element which most appeals to them. They no longer are satisfied merely to keep on the move, while the little verses which accompany so many of the young children's games seem to them foolish. Instead, they have the competitive instinct strongly developed—they are intensely anxious for their own side to win. Races, therefore, of one sort or another, are likely to appeal to them particularly.

In the Schoolroom

Overhead Race. Any objects which are not too heavy, as bean bags or books, are held aloft by the pupils in the front seats. All the other children sit erect also, with arms raised high above their heads, and at the given signal the bags are passed back from hand to hand until they reach the last pupil, when the process is reversed and the bags are passed forward. When a first seat pupil receives his bag again he rises to show that his row has won. This game never fails to rouse great enthusiasm, and the breathless haste which it calls for stirs up sluggish blood.

Another Bean-Bag Game. This is an excellent game but unless a number of boards are provided only a part of the children can take part in it each day. In a piece of thin board or heavy pasteboard are cut five holes, each six inches square, and these are numbered 10, 20, 30, 40, 50. This is placed in a slanting position, with one end raised about nine inches from the floor, and the players take their stand about ten feet from it and try to toss bean bags through the hole. Each successful throw credits the player with points according to the number of the hole through which the bag has passed, while every bag which falls on the floor takes ten from his count. Thus if a player throws six bags, sending one through the 10 hole, two through the 20, one through the 40, and two on the floor his score will be 10+40+40−20, or 70.

First In, First Out. Groups of three erasers or bean bags are placed in squares, marked on the floor with chalk in front of alternate rows. Beginning with the pupils in the front seats of these alternate rows, the players take one object at a time from each of the squares, placing them in similar squares at the back. They must run down one aisle and return by the other. As soon as all the objects are gathered they are brought back in the same way, and the pupils in the second seats continue the game without any interruption. Then the pupils in the third seats repeat the process, and so on down the row. The row which finishes first makes known the fact by clapping. Such a game is exciting and very enjoyable, and is excellent for giving an outlet for the repressed energies of children between the ages of ten and fourteen.

A similar game may be played in which the players run to touch front and back wall in succession and then take their seats. Such a game is excellent when time is limited.

Out-of-Doors

Tug of War. A chalk line is drawn and the players divide into two parties, one on each side of the line. Each group then grasps one end of a long strong rope and at the word of command the two sides begin to pull against each other. The side which pulls its adversaries over the dividing line wins the game.

Catch the Salmon. Two boys are chosen as "fishermen" and each grasps an end of a piece of strong rope. All the other players, the "salmon," take their place in the "sea"—which is the space marked off by a chalk line. The salmon-catchers may not cross this line, but may advance to it and try to throw their rope over a "fish," for the fish are daring and come very close to the line. Once caught a salmon may twist or jump or stoop, but he may not free himself with his hands, and when he is dragged across the line he must cease to struggle—he has been "landed."

Run, Sheep, Run. The players divide into two sides, each with a leader, and a goal is decided upon. One party remains at the goal, while the other goes off and hides, agreeing with its leader as to certain signal words. The leader then returns and stays near the other flock as it hunts for the hiders, calling out his signals from time to time to warn his flock. When he feels that the seekers are getting so close that discovery is certain, or when they have gone so far

from the goal that his flock may reach it first he calls "Run, sheep, run," and the hiders dash toward the goal. If they arrive ahead they have another chance to hide.

Other Games. Almost innumerable are the games which are adapted to these older children; many of them are so well known that it is necessary merely to mention their names. Last Couple Out and Three Deep are general favorites and many a picnic crowd beyond children's age finds in them much enjoyment. Fire on the Mountain, Prisoner's Base, Fox and Geese, Leap Frog and Crack the Whip are others which almost every child will recognize by name. In some of these, especially in the last-named, care should be taken lest they become too rough. Every group of children will suggest other favorite games.

Quiet Games

"What shall we do?" What mother has not heard that repeated, especially on stormy days, until she has dreaded the sound of the words. Here are a number of games which may be played indoors without any great amount of noise and all are so simple that children can play them.

Hot or Cold. One child leaves the room and some object is hidden by the others. When he returns and starts his search the others aid him by humming or singing, softly to show that he is "cold," or far from the hiding-place, and more loudly to show that he is getting "hot," or closer to the object.

Rhyme Words One player thinks of a word and tells the others, not the word itself but one that rhymes with it, while they try to find out the word by asking questions. For instance, "I'm thinking of a word," says the leader, "which rhymes with *can*." "Is it a color?" says one. "No, not *tan*." "Does it help to keep us cool?" "No, not *fan*." "Does it walk on two legs?" "No, not *man*." "Do we see it in the kitchen?" "Yes, it is *pan*." The one who has guessed correctly then chooses a word, and so the game goes on. This game may be varied by having the leader and guessers spell the words. Thus—"I am thinking of a word that rhymes with *f-a-n, fan*." "Is it *c-a-n, can?*" "No, it is not *c-a-n, can*." "Is it *p-a-n, pan?*" "Yes, it is *p-a-n, pan*." For the older children the game becomes interesting as a test of vocabulary and good spelling, and gives pleasure as a mental stimulus.

Ten Questions. An object is chosen in the absence of one player and he must then guess what it is by asking questions, limited in number to ten. Each of these must be in such form that the answer may be "yes" or "no," except the first, which is usually "Is it animal, vegetable or mineral?"

Buzz. Very little children cannot play at this, but all those who have mastered the multiplication table up to "seven times" will find it very interesting. Sitting in a circle the players count in turn, "One," "Two," "Three," and so on, but whenever seven or any multiple of seven or any number in which seven occurs is reached, *Buzz* must be substituted. Thus, 7, 14, 17, 21, 27, 28, and so on will not be named, the word *Buzz* taking their place. Any player who gives the number instead of *Buzz* must drop out.

Beast, Bird or Fish. One child stands in front of the rest and says rapidly, "Beast, bird or fish! —Fish, John," and John, or anyone else called upon, must then name a fish before the leader has counted ten. The three different classes of animals should not always be called for in regular succession as this makes the game too simple.

Kitty Miaou. The "cat" is stationed outside the door of the room within which the other players are assembled. In response to the cat's "miaou" one child after another repeats "miaou" while the cat tries to recognize each by his voice. The first one so recognized becomes the cat in turn.

Public Games

Wonderful as seems the great popularity of all modern competitive games, whether interscholastic or professional, these do not yet play so large a part in the life of the people as did the great games of the ancient peoples. Most of these were looked upon as religious festivals, and in no way could greater honor be shown the dead than by the celebration of elaborate games. In the *Iliad* Homer tells how the two [illegible] made a truce, that Hector, the great [illegible] hero, might be buried with fitting [illegible] games. These ancient games were [illegible]tions of strength or endurance [illegible]ning, wrestling, boxing, discus- [illegible]ariot-racing. No valuable prizes were given, but the simple laurel wreath which crowned the victor was looked upon by the Greeks as the highest honor a man could win. Best known of these famous game-festivals, which played a large part in Greek life by promoting national unity and by developing that type of "sound mind in sound body" which Greek art and literature depict, were the so-called Olympian Games (which see). In Rome the games were often of a lower and more brutal order, consisting of gladiatorial combats or of conflicts of men with wild beasts in the arena, but so thoroughly did they satisfy that "bread and the games" were the two things demanded from the emperors.

In modern times baseball is the great professional game in America, while other athletic games are largely the province of schools and colleges. Very pretentious are some of the great football struggles between large schools, and many thousands of people watch them with breathless interest. Some years ago the Olympian Games were revived as an international affair, and were of world-wide interest until interrupted by the War of the Nations.

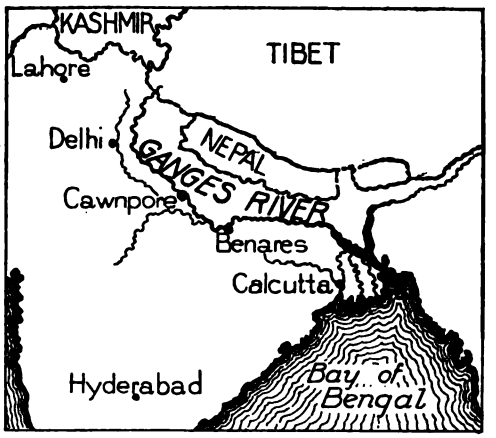
The great value of games is not that thousands shall sit cramped in uncomfortable bleachers in broiling sunshine to see a group of over-trained lads, who are often weakened by this over-strain, struggle in a game of football; but that all our youth shall receive, while still attending school, such training as will make for a completely rounded physical development. That this can be done, and joy and power be added, should be a cause of rejoicing, and the efforts of parent and teacher should be united to make our boys and girls stronger, more alert, better able to withstand all enemies of health—through consistent, normal, regular training in calisthenics, swimming, and out-of-door games that develop the muscles, train the eye and keep the heart clean and pure.

Every important competitive game, whether it be athletic, as baseball, football, golf or tennis; or mental, as chess, checkers or whist, is given full treatment in these volumes. F.H.

GANANOQUE, *gah nah nohk'*, a summer resort in Leeds County, Ontario, situated on the north bank of the Saint Lawrence River, at the point where it receives the waters of the Gananoque River. Brockville is thirty-four miles northeast. Railway transportation is provided by the Thousand Island Railway, which connects with the Grand Trunk Railway at Gananoque Junction, three miles distant. Steamers communicate directly with Toronto, Montreal, and Rochester and other Canadian and United States ports.

Gananoque is an Indian name, meaning *rocks on the water.* It refers no doubt to the Thousand Islands (which see) in the lower Saint Lawrence River, here nine miles wide. The town has a post office and customhouse, erected in 1914, a high school and a public library. The Gananoque River at this point has a fall of twenty-one feet, affording abundant water power. There are about twenty industrial establishments, engaged chiefly in making cheese and small foundry and machine shop products; there are also boat-building yards and granite quarries. Gananoque was incorporated as a town in 1890, and in 1911 had a population of 3,804. F.J.O'C.

GANGES, one of the world's great rivers, is to the Hindus the most sacred river of India, a stream whose waters, according to popular belief, work curative miracles and cleanse the body as no other water can do it. Holy cities



COURSE OF THE GANGES

line its banks, temples are approached by stairs or *ghats* direct from the water's edge, and it is a popular superstition that whosoever meets death in the river is borne on its waters to Paradise. At Benares, Allahabad and other cities many thousands of pilgrims meet every year for the purpose of bathing in the Ganges and taking home a little of the holy water. To the natives of Hindustan the Ganges represents the great center of religious life. To the modern Western mind the river appeals as the commercial route down which most of the great wealth of India floats to the sea.

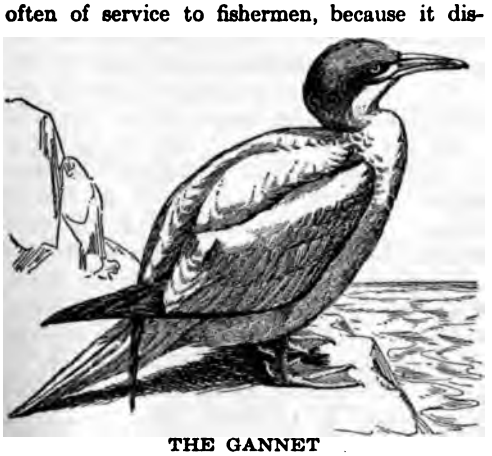
The river, which drains the slopes of the Himalaya Mountains, rises in a vast snow field 10,300 feet above sea level, and after a course of 1,557 miles it pours at the rate of about 400,000 cubic feet per second into the Bay of Bengal. Its basin covers an area of over 390,000 square miles of the most fertile and most densely-populated country in the world. The Jumna, Ramganga, Gumti, Gogra, Son and Kusi rivers swell its waters, which in rainy seasons overflow its banks for hundreds of miles. The mouths of the Ganges form the largest delta in the world. This great delta makes a network of dismal jungle and swamp land inhabited by crocodiles and other wild animals. Calcutta, Patna, Murshidabad, Cawnpore and Bahar are among the most important cities on its banks.

Ganges Canals, two irrigation canals running parallel with the Ganges for a distance of 100 miles, storing water for irrigation purposes. Together they water nearly 2,000,000 acres of land, on which rice, indigo, cotton, fruits and opium are grown in vast quantities. F.ST.A.

GANGLION, *gang'gli on.* See NERVOUS SYSTEM.

GANGRENE, *gang'green,* is mortification, or local death, of body tissues. There are two forms of the disease—dry and moist. The former is particularly a disease of old age, due to arterial changes, and its progress is extremely slow. Its symptoms are numbness, some pain and a drying and blackening of the skin. Moist gangrene results from infection, suspended circulation and other agencies which destroy the tissues. This form shows a soft discolored mass, covered with blisters, and is characterized by a disagreeable odor. In both forms of the disease there may be a zone of inflammation between the dead and living tissue called the "line of demarcation." Hospital gangrene was at one time frequently found in hospitals which were improperly conducted, from a sanitary standpoint. In these cases mortification quickly followed infection and demanded prompt surgical operation. Modern aseptic methods have abolished this form of the disease. The treatment of gangrene is usually a matter of incision or amputation well beyond the affected area, but in its early stages the disease may be checked by careful dietary and medicinal treatment.

GAN'NET, a large, white sea bird which is often of service to fishermen, because it dis-



THE GANNET

closes the location of schools of herring by following them and diving for the fish, which its main food. The birds have strong, sharp webbed feet, a small pouch beneath the throat, and are about three feet long. They make their nests of seaweed on rocky cliffs on Bird Rock and Bonaventure, in the Gulf of Saint Lawrence, and on islets off the British Islands. They are very tame, and the mother will not move off her one pale, bluish-white egg even when a person walks close to her. The young require nearly two months to complete their growth and remain mottled brown for three or four years.

GANYMEDE, *gan'i meed,* in mythology, was a youth of marvelous beauty, whom Jupiter (which see), in the form of an eagle, kidnapped and carried off to Olympus to be his cupbearer. Hebe, the goddess of youth, had always poured the nectar in which the gods often pledged themselves, until one day at a solemn occasion she tripped and fell. This accident disgraced her and she was forced to resign her office. So Jupiter, in the form of an eagle, left Olympus in search of her successor, and flew over the earth until he saw this beautiful youth, the son of the king of Troy. Swooping down, he caught the boy in his mighty talons and carried him back to the top of his mountain, where he was taught his duties as cupbearer to the gods. A marble statue, which is a copy of an early bronze statue by Leochares of Athens, representing Ganymede being carried off by the eagle, stands in the Vatican at Rome. Homer says:

"And godlike Ganymede, most beautiful
Of men, the gods beheld and caught him up
To heaven, so beautiful was he, to pour
The wine to Jove, and ever dwell with them."

GAPES, *gayps.* Poultry often have a disease which makes them open their beaks and cough continually. This disease is called *gapes,* and is caused by a tiny worm which lodges in the windpipe of the fowl. Gapes is not a fatal disease, but it prevents poultry from fattening. The best way to cure the malady is to make the fowls breathe the dust of air-slacked lime, which starts a violent coughing and dislodges the worm. Epsom salts added to the food may effect a cure. Another favorite method of dislodging the worm is with a feather dipped in turpentine. The coops, dishes and even the earth in the coops should be disinfected after the disease has been banished.

GAR. There are two kinds of fish that are called *gar,* or *garfish,* because they are much alike in structure and appearance. Both are long and slender, with round bodies and spear-like snouts which are filled with teeth. One

lives in the warm parts of the ocean, grows about two feet long and feeds on smaller fishes. It is often taken to the city markets, as it has a good flavor, something like that of mackerel. The other gar lives in the rivers and lakes of North America, grows to be about five feet long, but is not good to eat. Like the ocean garfish, it eats smaller fish and interferes with fishing by destroying nets, so it is killed freely. Many different species belong to this family.

GARAGE, *ga razh'*. The word is French, and it has been taken over without change of form or pronunciation into the English language; it means *keeping under cover,* or *to keep under cover,* and has become limited in its application to automobile storage rooms. Since automobiles have so largely taken the place of horses and carriages, the *garage* has taken the place of the old livery-stable and barn. It is a building where men clean, repair and store automobiles.

GARBAGE, *gar'baj,* is household refuse, chiefly of animal and vegetable matter. The problem of preventing refuse from becoming a menace to public health has always been important, and in many instances, difficult of solution. Garbage carelessly thrown out and allowed to lie on the ground soon becomes a prolific source of disease. Most cities have until recent years expended large sums in contracting for its disposal, but modern scientific study proves that instead of being an expense, garbage can be made an important source of municipal revenue. As the refuse comes from hotels, restaurants, private houses and other buildings it consists of a mixture of meats, fish, vegetables, bread, bones, bottles, paper, tins and the like. That such a collection should prove to be worth considerable money appears strange, yet it is true.

Cost of Removal. No matter how garbage is finally disposed of, whether dumped into a river or lake, used to fill in waste ground, burned, or turned to profit by scientific treatment, the most expensive item connected with its removal has always been hauling. From the nature of the garbage it is advisable that the removal be done at night, unless the most modern covered metal wagons are available. This adds to the expense, as night work is always more costly than day work. Each house and building is supplied with garbage cans of suitable size, into which refuse is thrown. These cans are collected and emptied into wagons, which are then hauled to the point of disposal. Contracts between municipalities and removers were formerly based on the principle of paying a certain sum yearly for the removal of the garbage. In many cities firms now contract and pay for the right to collect, remove and utilize the garbage, thus actually reversing conditions. In large cities the amount of garbage collected averages about 500 pounds per head of population per year. In a city like Chicago, with a population of 2,500,000, the contractor or the employees of the city itself must remove and dispose of 1,250,000,000 pounds, or 625,000 tons, of garbage annually. That means that whoever undertakes the work must be prepared to haul over 1,711 tons of garbage daily.

Value of Garbage. It has been found that not only can garbage be made to pay for its own removal but that it can and does produce handsome profits for those securing contracts for its disposal. Until recently, a contractor was paid $50,000 annually by the city of New York for the removal of garbage. That same contractor later offered to pay $130,000 for the right to remove and dispose of the garbage for a period of five years.

European cities, especially those in France and Germany, have been in advance of American communities in devising methods of effective utilization of garbage. In a typical up-to-date European plant the *pure garbage,* that is, the organic matter which remains after tin cans and similar objects have been removed, is boiled for eight hours or more, then subjected to high pressure to eject moisture, after which it is dried, screened and ground. Of the resulting substance, called *tankage,* from three to four per cent is ammonia, five to ten per cent bone phosphate, and one-half to one-and-a-half per cent potash. These elements make the tankage a fertilizer; though not a very valuable one, it has the advantage of containing only a small amount of fat, which is a drawback in such fertilizers as cotton seed. The grease which is removed from the tankage by pressure is valuable for soaps, glycerine, nitroglycerine, dynamite and other fat-products. In some American plants the grease is extracted by treating the garbage with hot naphtha.

The garbage which is not fit for tankage contains many substances, such as rubber, paper and metal, which may be sold to dealers in them. The residue may be burned as fuel in electric light or steam plants. In America it is a common practice to burn the entire

quantity of a city's garbage, but this is very wasteful, as at best only the bone phosphate and potash can be saved. C.H.H.

Consult Morse's *The Collection and Disposal of Municipal Waste;* Parsons' *The Disposal of Municipal Refuse.*

GARCIA, *gahr the'ah,* the name of a family of celebrated Spanish musicians and singers, of whom MANUEL DEL POPOLO VICENTE GARCIA (1775-1832) was the father; MANUEL GARCIA (1805-1906), the son; and MARIA FELICITA GARCIA (1808-1836), better known under her subsequent name of MALIBRAN, was the daughter.

The father was an eminent Spanish vocalist, music teacher and composer, born at Seville. In 1808 he went to Paris and met with great success in Italian opera. Later he studied the Italian method in Italy, where he duplicated his former triumphs, and then went to London. In 1826 he toured the United States and Canada, with a company of excellent talent, among them his son and daughter; this event marked the introduction of Italian opera to American audiences. He and his company gave seventy-nine representations, including two of his own operas. He extended his operatic tour as far as Mexico, where he was robbed of his wealth by bandits.

To few men is given the privilege of celebrating their hundredth year of life, but this was granted to Manuel Garcia, on March 17, 1905, in London, in the presence of over four hundred guests distinguished in the scientific and musical world. On that occasion he received decorations from King Edward VII of England, Emperor William of Germany and King Alfonso of Spain. At the age of twenty he was well known as a singer, composer and orchestra conductor. After a successful operatic tour in America as a member of the company with his distinguished father and sister, he returned to Paris and became famous as a teacher of singing. Jenny Lind was one of his pupils. He is famed in the scientific world also as the inventor of the laryngoscope, the idea for which was gained by the accidental placing of two small mirrors by which he was enabled to note the position of the vocal chords during singing.

The daughter, Maria Felicita Malibran, was born in Paris. She possessed a soprano voice of great sweetness and phenomenal compass. When but seventeen years old, she played the leading rôle in *The Barber of Seville,* at Covent Garden, London. Her gifts as an actress were on a par with her beautiful voice, and she made her greatest triumphs in tragedy. She was unhappily wedded to a New York banker, named Malibran, whom she divorced. Later she married a Belgian violinist, Charles de Beriot. R.D.M.

GARCIA Y IÑIGUEZ, *gahr se'a e ene'ges,* CALIXTO (1836-1898), a Cuban soldier-patriot who gave thirty years of his life to the cause of the freedom of his native land, and who died on a mission in its behalf. He was born at Holguin, Santiago Province. For a while he practiced law, but in 1868 became a leader in the Cuban insurrection known in history as the Ten Years' War. When General Máximo Gómez was removed from command by the government, Garcia succeeded him as commander-in-chief of the Cuban forces. At one time, with a band of only twenty men, Garcia was surrounded by 500 Spaniards. Rather than be captured, he attempted suicide by shooting himself through the head. He recovered, however, and was taken to Spain, where he was held a prisoner for fifteen years. He escaped in 1895, the year of Cuba's final insurrection, and went to the United States, where he engaged in filibustering. Eventually he succeeded in reaching Cuba and joining the native forces and soon won important victories as one of the chiefs of the Cuban forces. He died in Washington during a conference at which Cuban affairs were being discussed.

When the United States decided to go to the rescue of Cuba, and war broke out between that country and Spain, one of the first things to be done was to communicate with the insurgent leader, Garcia. No one knew just where he was, and the task was a dangerous one. The way a man named Rowan, without a question which would disclose his identity or arouse suspicion, faithfully delivered that communication to Garcia in the wilds of Cuba, inspired Elbert Hubbard's *A Message to Garcia.* It is a pamphlet which carries an inspiring message.

GARDEN, MARY (1877-), a grand opera star, who was as great an actor as a singer, was born in Edinburgh, Scotland. She moved with her parents to Chicago at the age of eleven, where she remained until nineteen, when through the aid of friends she was enabled to continue her musical education. Miss Garden is regarded as practically self-taught, as she had very little instruction at home, but made much of two years of study abroad; she learned her art upon the stage, for the most part, and her opportunity came quite unex-

pectedly. Charpentier's new opera, *Louise*, greatly appealed to her, and she learned the title rôle at a time when there was not the slightest prospect of ever appearing in it. One night in 1900 the singer who had the rôle of Louise became suddenly indisposed. It was Mary Garden, unknown and unrehearsed, who was called to make her professional debut in the third act and to carry off the triumphs of the evening. Her interpretation brought instant fame, and within a week the youthful choir singer from Chicago became one of the stars of the Opera Comique and the favorite of Paris. In addition to the rôle of Louise, which she has presented over two hundred times, she has appeared in many other notable operas, but won her greatest successes in *Pelleas and Melisande, La Traviata, Helene, Manon, Thais* and *Cherubin*.

MARY GARDEN

GARDENIA, *gahr de'ni a*, a shrub of the madder family which is cultivated in a double-flowered variety in hothouses everywhere. Its waxy-white, sometimes yellow [illegible] some are attractive in [illegible]. The variety is also found as a hardy outdoor plant in the Southern United States. In the gardens of Charleston, S. C., they are objects of special pride, for the genus was named by the botanist Linnaeus, after Dr. Alexander Garden, a citizen of Charleston.

GARDENIA
Flower and leaves

Cape Jasmine is another name popularly given these tropical and subtropical shrubs although they are not related to true jasmines. One species, however, is abundant at the Cape of Good Hope and they somewhat resemble jasmines, hence the name. In South Africa the very hard wood of the shrub is used for agricultural implements and other useful articles. The best known species was brought to America from China, where the orange-colored fruit or berry is used as a dye. The leaves are dark green, smooth and lance-shaped. They cluster closely about the camellialike blossom with its smooth, thick petals, which are so delicate they will turn brown at the slightest bruise. See JASMINE.

THE STORY OF GARDENING

GARDENING, the art of working hand in hand with Nature, which gives us cultivated flowers and plants to delight the eye, and fruits and vegetables to nourish the body.

Gardening is the oldest of all the arts. Tennyson calls Father Adam "the grand old gardener," and Shakespeare says, "There is no ancient gentlemen but gardeners." Two thousand years before Christ the Egyptians had irrigated gardens; the Babylonians knew the Hanging Gardens of Nebuchadnezzar, one of the Seven Wonders of the World; and in all countries and ages since, people have made gardens for their use and pleasure (see HANGING GARDENS OF BABYLON).

Never before, however, has so much attention been given to this delightful and profitable occupation as in the twentieth century. Perhaps some of this interest can be traced to the *school gardens* which have recently become such an important part of the study course, both in rural and in city districts. Again, the city man's backyard gardening is an attempt to reduce the constantly-increasing cost of living as well as his way of getting "back to the land." So important does the promotion of

home and school gardening seem to the United States government that the Bureau of Education has established a School and Home Garden Division, with experienced teachers in charge, who devote their entire time to investigating and directing garden work in the big cities.

Specialized Gardening. A farmer is only a gardener on a large scale. A gardener who specializes in vegetables is usually called a *truck,* or *market, gardener;* a specialist in fruit, a *fruit-grower,* or *orchardist;* a specialist in flowers, a *horticulturist.* A *landscape gardener* is an artist engaged by large estates or public park commissioners, who, instead of paints and oils, works with flowers, shrubs, trees, lawns, drives and fountains to paint nature pictures that change with every season and almost with each hour of the day.

What a Garden Teaches. A garden is like a very wonderful school where all the instructors teach by silent but interesting object lessons, and where all the pupils "learn to do by doing." It teaches more practical botany than a nature-study course; but it is not merely botany: it joins hands with the study of birds, bees and butterflies, insects and plant bacteria, with the lore of the weather and the seasons, the chemistry of the soil, the use of tools.

A garden is of physical benefit through the healthful outdoor exercise its cultivation affords; and such exercise has an added value because it is really *creative.* Moral education it gives, too, in lessons of tenderness for helpless things; lessons in responsibility, patience and perseverance, and that vital lesson all must learn—that any success worth having results from work. A garden teaches regard for the rights of others, because a child who has cared for a plant from its seedtime understands what ownership means.

A garden is an education in the appreciation of beauty, color, artistic arrangement and fragrance. It provides a "first course" in the love of Nature. Being such a little corner of the great outdoors, it permits a closer intimacy with Mother Nature than great woods and rolling stretches of countryside can ever give. Looked at from the purely commercial point of view, a garden is an education in economics. A boy or girl who keeps the home table supplied with fresh fruits and vegetables learns how work changes itself into pennies, which grow into dollars. A garden helps to form the good habit of thrift when its surplus is sold and the boy or girl encouraged to put this money in the bank or to spend it wisely. In many families parents find it a good plan to pay the little gardeners for all produce used for the table, realizing how great an incentive this supplies to steady and enthusiastic work.

The Site and the Plan. Whenever there is any choice in the matter of selecting the location of the garden, the important points to be considered are *soil* and *exposure.* A southern slope with shelter on the north gives ideal results. At any rate, the garden should be in a free, open space, away from shade and big trees, so that Nature's handmaids—sun and air—may work their magic without interference.

The second thing to decide is what kind of a garden it is to be—whether a vegetable garden, a flower garden, or a combination of the two.

Next comes the making of a "working plan," on paper. This should be a diagram, drawn to scale—say, a quarter of an inch for each foot of space—and should show the exact widths and arrangement of beds, paths and borders. Whenever possible the beds should be so arranged that the rows will run north and south, to give the plants the full benefit of the sun from morning till evening. So much depends upon space and purpose that it would be useless to try to present a suggestive plan in this brief treatment. Home-making magazines and special gardening periodicals should be consulted, as well as the many attractive and inexpensive books on the subject, for there is no art that has a larger or more fascinating literature.

As to the size of the garden, the beginner must beware of "o'erleaping ambition." Planning and seed-planting are easier than cultivating. A neglected garden may be worse than useless, while even a small plot well tended will yield good profit and endless satisfaction. It is wise to begin on a small scale, find out by experience how much can be well done and then extend operations from season to season. A small bed for a young child, a plot twenty-five feet square, more or less, for an older boy or girl, will afford excellent training and practice, and from these modest beginnings the garden may be increased year after year. The novice should confine himself to the common and easily-grown varieties, whether among vegetables or flowers. In the flower garden, annuals and vines that grow quickly are encouraging for the beginner. The hardy perennials, which bloom year after year,

are also a wise choice, especially for anyone whose gardening time is limited.

Getting the Soil Ready. If seeds are to be properly nourished when planted they must be dropped into ground that is well supplied with plant food. One of the most important of these foods is nitrogen, usually given to the soil by spreading over it a coating of stable manure three or four inches deep. Again, if the tiny rootlets are to send their fibers down through the ground for food and moisture, and if the young plant is to push its way upward into the sunlight, the soil must be soft and fine. To make it so, the garden plot must be thoroughly spaded and dug to the depth of a foot. It must then be turned over again and again with hoe and rake, until all lumps are broken up. Spading and raking are to small gardens what plowing and harrowing are to large farms. Next, since the soil needs potash and phosphoric acid, as well as nitrogen, to feed to its plants, wood-ash and bonemeal should be sprinkled upon its surface, or one of the good chemical fertilizers sold in the stores should be obtained. By working this in thoroughly the soil will become pulverized and mellow.

Planting the Seed. All planting must be done on a freshly-prepared surface; that is, the ground must be watered, hoed and raked smooth just before the seeds are put into the ground, no matter how much previous work has been done.

Only good seed will produce healthy plants; therefore it should be bought at a reliable seed-house and then tested before planting. A simple testing method is explained in the article on SEEDS. The very tiny seeds are usually scattered on the soft ground and pressed in firmly with a smooth board; larger ones are planted at varying depths. During the summer seeds need to be planted deeper than in springtime, because it is necessary to go farther down to find moist soil. The *planting table* in the article VEGETABLES gives definite instructions for planting vegetable seeds; a similar one for flowers will be found under that article, subhead *Suggestions for a Flower Garden.*

After the planting, the soil must be pressed or stamped down firmly, bringing the earth in contact with the seed, and making it compact enough to hold the moisture needed for germination. Each row or bed should then be tagged with a thin wooden marker on which are written the kind of seed and the date of planting.

When to Plant. Planting time varies in different localities and in different years. Experienced gardeners go according to the fruit-tree calendar. When the peach and pear are in bloom they plant the hardy vegetables, such as onions, lettuce, radishes, spinach, beets, parsnips, turnips and the like. When the apple blossoms appear they plant the more tender varieties, like beans, corn, melons, pumpkins and cucumbers. Most of the flowers, with the exception of the sturdy little pansy and a few others, also need to be held back until this more conservative time. However, if the gardener wishes to get an early start he plants his seed in a hotbed or cold-frame, which is easy and inexpensive to make, or starts it in pots or "flats," kept indoors. Then he waits with his transplanting until the warm weather has come to stay, which is generally when apple-blossom time is past.

What Cultivation Means. Cultivating the ground means keeping it well fed, well stirred and well watered. Occasionally, particularly if the garden does not seem to be thriving, a fertilizer should be sprinkled upon its surface. Different soils need different treatment, but one of the best all-round fertilizers is bonemeal. When manure is used care must be taken not to let it come in contact with the plant itself. Lime helps to keep the soil sweet. Mulch, a light layer of fine soil kept on the garden surface, assists the ground in retaining its moisture and keeps out weeds; it is secured by hoeing the ground and then dragging a rake lightly over it. Frequent sprinkling with a hose is necessary.

Protecting the Garden. Every garden is a battlefield, with the flowers, vegetables, birds and gardener in league against destructive insects and troublesome weeds. The fight against the weeds must begin the minute they send their unwelcome stalks through the earth, for they are using up food that belongs to the rightful possessors of the soil. The younger they are, the easier to uproot, and if the war is well fought in the beginning of the season, the later struggle will be less strenuous. Constant stirring and mulching of the soil discourages the weeds, and the garden more than repays the time and effort bestowed upon it by looking trim and yielding abundantly. The United States government has given special attention to the weed problem of farmers and gardeners in its bulletin entitled *Weeds and How to Kill Them;* this pamphlet may be obtained through the Department of Agriculture.

A VILLAGE BACKYARD AS IT FREQUENTLY APPEARS

Among the insect foes of the garden are those that actually devour the plant and those that injure it by sucking its juices. The weapon used against the eating insects is poison, such as Paris-green or Bordeaux mixture, which is sprayed on the leaves. The sucking insects have to be deluged with liquid or powder; lime, soot, tobacco dust and kerosene emulsion are among the usual remedies. The cutworm, which comes early and does fearful damage all summer, is best conquered by feeding it poisoned bran mash; the rose-borer is fought with hellebore. The different vegetables have special enemies, each of which is susceptible to certain poisons and not to others.

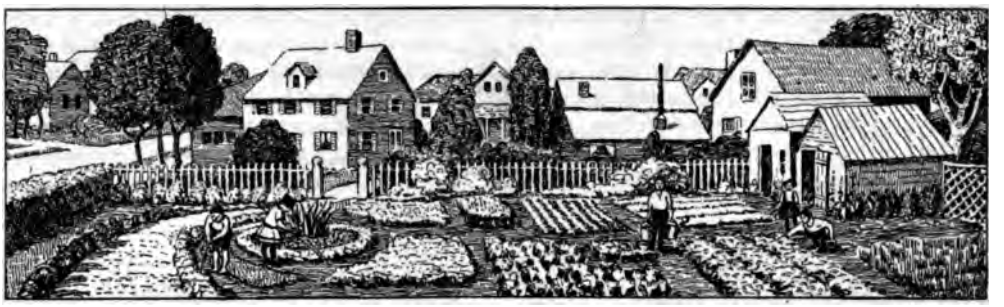
In a small garden the insect population can generally be kept down by going over the patch systematically every day, particularly early in the season, picking off the bugs and dropping them into a can of kerosene. A weedless garden has few insect invaders. And, of course, the birds and toads are constantly coöperating with the garden's owner, so that by encouraging the presence of these allies he will find his labors greatly lightened. A birdhouse and a drinking basin will attract the winged helpers (see illustration, in the article BIRD). A dark, cool corner fitted up with a few stones, or a box lying on its side under a bush, will furnish the toad a home in which he will live contentedly as assistant gardener.

Making the Garden Pay. There is profit in gardening, even for a boy or girl who has only after-school and vacation-time to give to it. Many an unattractive backyard or empty lot, such as the one shown in the accompanying illustration, which has been a mere dumping-ground for rubbish, has been transformed by the children of the family into a commercial success like that shown in the second picture. Such a transformation pays cash dividends on time and effort, besides making the home surroundings pleasanter and more healthful.

It is an easy matter to find customers for the surplus garden produce, for there is always a demand for home-grown vegetables and berries. A boy who goes into gardening as a business should concentrate on one or two vegetables; first, in order to have a sufficient output for the market, and, second, because it means less effort and greater returns. When he has mastered these he can add others to his list. Specializing has good profit in it, however, and many experienced gardeners prefer to devote their entire time to a single crop.

The young gardener may work up a route of private customers in his own neighborhood; he may sell to the town grocers or hotels; or he may dispose of his produce by shipping to outside points. The parcel post offers an ideal rapid delivery service for garden products. He should consult with an experienced shipper in order to learn how to prepare his vegetables most attractively and how to pack them in the best way. Good advice is contained in the United States government bulletin on *Marketing by Parcel Post*. Many a boy has in this manner made his vacation pay for the following year's work in college. There are indirect profits, too. Prize specimens of garden art often win worth-while cash rewards at state or county agricultural exhibits; and more than one amateur gardener, branching out into general farming, has found his early experience in the home garden a valuable asset.

Girls as well as boys can make money by selling flowers to florists or to people who lack flower gardens, or by raising young plants in hotbeds or flats for supplying neighbors who might not otherwise be tempted to make gardens. Pansy plants, especially when they have begun to bloom, are very quickly disposed of. Seeds and bulbs can be sold in a small way. Boys and girls may also do garden service, charging for their work by the hour and thus turning their knowledge into cash.



THE SAME BACKYARD TURNED TO PROFIT

Canning and preserving the surplus vegetables and fruits of the garden is a home industry in which women and girls are finding wide scope for profitable work. Some practical instructions along this line can be secured from the United States Department of Agriculture. The agricultural departments of the Dominion of Canada and of the several provinces also issue bulletins containing practical suggestions for various lines of gardening. L.M.B.

Consult Bailey's *Garden Making;* Duncan's *When Mother Lets Us Garden;* Higgins's *Little Gardens for Young and Old.*

Related Subjects. The following articles in these volumes contain much material which will be helpful in connection with the above. A number of these articles contain lists of related subjects, and to those also the reader is referred.

Agriculture	Grafting
Annuals	Horticulture
Bird	Insecticides and Fungicides
Botany	Perennials
Boys' and Girls' Clubs	Plant
Breeding	Pollen and Pollination
Bulb	School Garden
Canning Clubs	Seeds
Cross-Fertilization	Soil
Fertilizer	Vegetables
Flowers	Weeds
Fruits	

GARDEN OF THE GODS, the name given to a 500-acre region in Colorado, between Manitou and Colorado Springs, noted for its many curiously-shaped red and white sandstone formations. Among these are the *Cathedral Spires, Balanced Rock, Siamese Twins* and the *Seal and the Bear.* The gateway consists of two masses of red rock, 300 feet high, and only wide enough at the bottom to admit a vehicle. These grotesque masses are the remains of mountains worn and washed away by the winds and waters. A magnificent view of Pike's Peak is obtained from the Garden.

GAR'DINER, SAMUEL RAWSON (1829-1902), an English historian, author of numerous historical works of recognized value. His *Students' History of England* and *An Introduction to the Study of English History* are widely used as textbooks in English and American schools. The most important of his works, marking him as an historian of very high order, are *The History of England from the Accession of James I to the Outbreak of the Great Civil War, The History of the Great Civil War,* and *The History of the Commonwealth and Protectorate.*

GARDI'NER, STEPHEN (about 1493-1555), a famous English churchman, who played in his day a rôle scarcely second in importance to those of Wolsey and Thomas Cromwell. As the secretary of Wolsey he was sent by the king to Rome in 1528 to persuade the Pope to allow Henry to divorce his wife. Though he was unsuccessful in this, and later refused to give up his Catholic faith, Henry continued to shower honors upon him. Under Edward VI he was imprisoned, but Mary restored him to his high place.

GARD'NER, MASS., a town in Worcester County in the north-central part of the state, of special importance as a center of chair manufacture. Fitchburg is fifteen miles east and Worcester is twenty-six miles southeast. Gardner is on the Fitchburg River and on the Fitchburg branch of the Boston & Maine Railroad. The population was 14,699 in 1910, and 17,140 in 1916, by Federal estimate.

Gardner includes South Gardner, West Gardner and Gardner Center, covering a total area of over twenty-one square miles. The town is pleasantly situated on seven hills and includes Dunn and Crystal Lake parks and some small streams. It contains the Levi Heywood Memorial Library and Muscum, the Henry Heywood Memorial Hospital, a state colony for the insane, an almshouse and a home for the aged.

The industry of chair-making at Gardner dates from 1805. Levi Heywood (1800-1882)

was a local inventor of chair-making machinery and a manufacturer. Rattan goods, silverware, go-carts, machinery, pails, tubs, toys and oil stoves are other important manufactures. Gardner was named in honor of Colonel Thomas Gardner, a Massachusetts patriot who died from a wound received in the Battle of Bunker Hill. The settlement was incorporated as a town in 1785. It is governed by town meetings, following the practice begun in colonial days, convened when necessary. M.N.W.

GARFIELD, JAMES ABRAM (1831-1881), an American soldier and statesman, and the twentieth President of the United States. He was the fourth President to die in office and the second to meet a martyr's death. Garfield was a self-made man, in the very best sense of the word; without great genius, he won high rank in many fields through industry, perseverance and courage. As a teacher he kindled in his pupils a longing for truth which led them to regard him as one of the great teachers, to be compared with men like Arnold of Rugby. As a soldier he rose in two years to high rank, and would have risen higher but for a call to other duties. In Congress he became the leader of his party, yet he was not as great a party leader as some others of his time, because he frequently sacrificed party expediency to the national good. He was a far-seeing statesman who never lost sight of everyday morality.

As an orator, his own earnest faith made people listen to him with respect and he never stooped to oratorical tricks. His speeches seldom rose to lofty heights, yet he was always impressive. When he heard the news of Lincoln's death, he spoke a few simple words, from the balcony of the New York customhouse, which calmed a frenzied, horror-stricken mob: "Fellow citizens: Clouds and darkness are around Him; His pavilion is dark waters and thick clouds; justice and judgment are the establishment of His throne; mercy and truth shall go before His face! Fellow citizens! God reigns, and the government at Washington still lives." Only sixteen years later, he himself met death as Chief Executive at the hands of an assassin.

Youth and Young Manhood. James Abram Garfield was born in a log cabin at Orange, Cuyahoga County, Ohio, on November 19, 1831. His parents had moved from New York state to the Western Reserve only the year before. Abram Garfield, the father, made a good beginning on his new farm, but died before his son James's second birthday. Though James was the youngest of four children, his youth did not prevent him from doing his share of work. At the age of ten he was accustomed to hard manual labor, and he added his mite to the family income by working at every opportunity for the neighboring farmers. Meanwhile he had made great progress in his schooling. He read all the books he could buy or borrow, and he was especially fond of the Bible and of American history.

About his fourteenth year his imagination was kindled by a volume of tales of the sea; he wanted to be a sailor and to live a life of adventure. The quiet routine on the farm no longer satisfied him, and with his mother's permission he went to Cleveland, where he intended to ship as a common seaman on a lake schooner. He got no farther, however, than the deck of the first schooner he saw, when the captain spied him and urged him to get back to shore. Though somewhat disheartened by his experience, young Garfield determined not to return home without adventure and without money. Wandering about the city in search of work, he met a canal boatman, who hired him to drive his team along the towpath of the Ohio Canal. In later years Garfield never said much about this experience, but it is known that he was soon promoted from the towpath to a position on the boat. After several months an attack of ague sent him home and it seems to have banished any further desire to work on the canal.

It was then the boy's ambition to be a

teacher, and with this end in view he entered Geauga Seminary at Chester, ten miles from his home; then from 1851 to 1854 he studied at the Western Reserve Eclectic Institute, now called Hiram College. In the vacations he learned and practiced the trade of carpentry, helped on the farms at harvest time and taught school to earn money for his education. After his first term at Geauga Seminary he asked and needed no financial assistance from his mother.

During the three years Garfield spent at Hiram College he not only earned his way, but he saved $350 towards the expense of several years at an Eastern college. After hesitating as to Yale, Brown or Williams, he finally chose the last, chiefly because Mark Hopkins,

JAMES ABRAM GARFIELD

Of his brief and tragic career in the Presidency Woodrow Wilson, a later President, in his *History of the American People,* says: "Office seekers swarmed about the President with quite unwonted arrogance, and before he had been four months in his uneasy place of authority one of the crowding throng whom he had disappointed wreaked foul vengeance upon him."

its great president, wrote him a friendly letter of encouragement. There was some feeling among his friends and the members of his family that Garfield should have chosen Bethany College, in West Virginia, an institution controlled by the Disciples of Christ. Garfield was by nature religious, and he had recently been received into that denomination, of which his mother was also a member. The actual reasons he assigned for his decision against Bethany College revealed the independence of mind which was one of his most pronounced characteristics. In addition to the fact that the course of instruction at Bethany was limited, he said that Bethany was too friendly toward slavery, and, most significant of all, that as he had "inherited by birth and association a strong bias toward the religious views there inculcated, he ought especially to examine other faiths." Two years at Williams College completed his formal education, and in 1856 he returned to Hiram College to teach Latin and Greek.

Up to that time Garfield had given no indication of great ability. He was industrious, conscientious and courageous, but by no means conspicuous for his superiority. He had, however, laid a firm foundation, and within the next seven years was in turn professor, college president, state senator, major-general in the United States Army, and member of the National House of Representatives. This is a rise to fame paralleled in the lives of but few men.

In 1857, when only twenty-six, he was chosen president of Hiram College. As a teacher he was remarkably successful, because his own youthful enthusiasm, his thirst for knowledge and his regard for the truth communicated itself to his pupils. His classes discussed almost every subject of current interest in science, religion, ethics, art and scholarship, and felt his influence at every point. He occasionally preached, a practice permitted by his Church, and he was also studying law. At first he seems to have taken no interest in politics, but when the slavery question, which he thought a moral issue, became political, he sought every possible opportunity to oppose it. His prominence among anti-slavery men in Ohio led to his election, without solicitation on his part, to the state senate. There his industry and versatility were again apparent, and he investigated and made reports on such widely separate fields as geology, parliamentary law, education, finance and the state militia.

Garfield as a Soldier. In August, 1861, the governor of Ohio commissioned Garfield lieutenant-colonel of the Forty-Second Regiment of Ohio Volunteers. Most of the members of the regiment were graduates or students of Hiram College and were drawn into the army by Garfield's example. Very soon promoted to the rank of colonel, he reported with his regiment to General Buell, then in Louisville, Ky. Buell was so impressed by the efficiency of Garfield's regiment that he gave him the command of a brigade and ordered him to

drive the Confederates out of Eastern Kentucky. A fortnight later Garfield won the Battle of Middle Creek (January 10, 1862), on a field chosen by the enemy, who also had the advantage of superior numbers. This victory, followed by General Thomas's success at Mill Spring, nearly ended Confederate hopes in Kentucky. Garfield's services were acknowledged by the President in a general order to the army, and he was appointed brigadier-general. He reached Shiloh in time to take part in the second day's battle, was prominent in all the operations around Corinth, and showed considerable engineering skill in rebuilding bridges and the fortifications of Huntsville.

During the winter of 1862-1863 he was in Washington as a member of the court which court-martialed General Fitz-John Porter, but in February, 1863, he rejoined the Army of the Cumberland as chief of staff to General Rosecrans. During the Battle of Chickamauga, when a blunder caused the defeat of the Federal right, Garfield rode under fire to carry the news to Thomas, and under Thomas's orders helped to save the left from rout. For his services in this battle Garfield was commissioned major-general. Shortly afterward Thomas took command of the Army of the Cumberland and asked Garfield to take command of a division. Garfield was only thirty-two, with every prospect of a brilliant military career, but at the earnest request of President Lincoln and Secretary of War Stanton he resigned from the army and took his place in a new field.

Garfield in Congress. In 1862, while still in active service in the army, Garfield was elected to Congress; he took his seat in December, 1863. Lincoln urged him to take this step, with the plea that he could be of greater service to the Union while in Congress than in the army. Garfield's reputation as a soldier secured for him a place on the Committee on Military Affairs, an unusual honor for a new member, for the committee was at that time the most important in Congress. His authority on military matters won quick recognition, and his opinion was frequently sought as that of an expert.

At the close of the war he was transferred, at his own request, to the Committee on Ways and Means. His reason for choosing this new field was that, the war being ended, financial matters would demand first attention, and he [illegible] his share in their treatment. His capacity for hard work later won him a place as chairman of the Committee on Banking and Currency and of the Committee on Appropriations. Throughout the Reconstruction period Garfield was allied with the radical Republicans. He opposed Johnson's policies and voted for his impeachment. He was from the first an advocate of sound money, and never lost a chance to tell Congress and the country the necessity of saving the country's financial honor.

In 1876 he went to New Orleans, at President Grant's request, to watch the counting of the Louisiana vote, and in the next year, although he had been opposed to an electoral commission in the Hayes-Tilden controversy, was himself chosen a member by acclamation (see ELECTORAL COMMISSION). After Blaine's transfer from the House to the Senate in 1877, Garfield became the undisputed leader of the Republicans in the House. In January, 1880, the Ohio legislature elected him to the United States Senate, but he never took his seat.

The Election of 1880. In the national Republican convention at Chicago, in June, 1880, James A. Garfield sat at the head of the Ohio delegation. Ohio wanted the nomination of John Sherman, and Garfield nominated Sherman in a remarkable address. But a large number of delegates were pledged to James G. Blaine, and a still larger number wanted to nominate Grant for a third term. The Grant adherents were the "stalwarts," led by Conkling and Arthur of New York; the opposition to Grant gloried in the name of "half-breeds." For thirty-three tiring ballots Grant had from 300 to 700 votes in the convention, the remainder being divided among Blaine, Sherman and George F. Edmunds. Garfield had

ELECTION OF 1880

Garfield and Arthur received 214 electoral votes from Republican states; Hancock and English received 155 Democratic votes.

received one or two votes from time to time, but had not been seriously considered until the thirty-fourth ballot, when Wisconsin gave him thirty-six votes. On the thirty-sixth ballot he received a majority of the votes, and was declared nominated.

In the campaign which followed Garfield established a new precedent by making speeches in his own behalf in Ohio, New York and several other states. An attempt was made to connect him with the Credit Mobilier (which see), but no proof of personal corruption was ever offered. That the people at large believed in his innocence was shown by the result of the election, in which he received an electoral vote of 214 to 155 for Winfield S. Hancock, the Democratic candidate.

Garfield's Brief Administration. When Garfield entered office, it seemed that his administration was to be most successful. Both publicly and privately he announced his desire to unite all factions of his party and of the people in his support, but his hope was not fulfilled. With the exception of Robert T. Lincoln, Secretary of War, his strong Cabinet was composed entirely of "half-breeds," Blaine himself being Secretary of State. The President, however, recognized the stalwart faction in the nomination of about a dozen important officers in New York, all apparently with the approval of Conkling and Platt, the Senators from that state. Then he sent to the Senate the nomination of William H. Robertson as collector of the port of New York. Robertson was one of Conkling's bitterest political foes, and Conkling tried to prevent confirmation. The Republican Senators, yielding to Conkling's wishes, agreed in caucus to allow the nomination to lie over from May until December. This was a victory for Conkling, but the President met this move by withdrawing the dozen nominations which pleased Conkling. Conkling and his colleague, Senator Platt, thereupon resigned and appealed to the New York legislature for reëlection to vindicate the right of Senatorial patronage. The legislature refused to reëlect them, and meanwhile the nomination of Collector Robertson was confirmed.

On the morning of July 2, 1881, President Garfield was in a holiday mood. Twenty-five years before he had been graduated from Williams College, and on this day he was to go back to his *alma mater* for his twenty-fifth reunion. As he was walking through the railway depot in Washington, arm in arm with

Outline and Questions on James A. Garfield

I. Early Years

(1) Birth and parentage
(2) Early need for hard work
(3) Beginnings of an education
(4) "On the towpath"
(5) In institute and college

II. Rapid Rise to Prominence

(1) Work as teacher
  (a) Reasons for success
(2) As president of Hiram College
(3) Interest in the slavery question
(4) In the state legislature
(5) As a soldier
  (a) Battle of Middle Creek
  (b) Gallant services at Battle of Chickamauga
(6) In Congress
  (a) Work on committees
  (b) Policy during Reconstruction period
  (c) Republican leader of the House
(7) Election of 1880
  (a) Garfield's place in Republican convention
  (b) Chosen as compromise candidate
  (c) Elected President

III. Administration

(1) "Stalwarts" and "half-breeds"
(2) Break with Conkling
(3) Star Route frauds case tried
(4) Death at the hands of a disappointed office-seeker

IV. Summary

(1) Not a great genius
(2) Remarkable rise to power due to industry and perseverance
(3) Rank as an orator

Questions

What characteristic reason did Garfield give for not attending a college of his own religious denomination?

When did he give up a promising career because he was convinced that he could do more good elsewhere?

What was the motive back of the assassination of the President?

What particular form did the love of adventure take in the boy Garfield? What was the outcome of his search for adventure?

Who were the "half-breeds," and what part did they play in Garfield's brief administration?

In how many fields did Garfield win distinction?

Why may it justly be said that his rise to fame was more rapid than that of almost any other American?

On what important committees did he serve in Congress?

What were Garfield's favorite books when he was a child?

Of whom was his regiment chiefly made up at the outbreak of the war?

Tell how he happened to be nominated for the Presidency.

Give his significant comment on the death of Lincoln.

What led him to take his first interest in politics?

Why did he never take the seat in the Senate to which he was elected?

James G. Blaine, he was approached by Charles J. Guiteau, a lawyer who had sought in vain to be appointed United States consul-general at Marseilles, France. Guiteau suddenly raised a pistol and fired twice at the President, the second shot taking effect. The President was carried to the White House, where he suffered for ten weeks. Towards the end of the summer his condition became worse, and the doctors decided that his only chance for recovery lay in removal to a more invigorating climate. On the sixth of September he was taken to Elberon, N. J., but blood poisoning developed in about ten days, and on the nineteenth of September, 1881, he died. His body now lies in a splendid tomb in Cleveland, Ohio. Guiteau, the assassin, was a "stalwart" Republican, and when arrested after the shooting declared frankly that it had been his purpose to throw the government into the hands of Vice-President Arthur. It was apparent, however, that Guiteau was mentally unbalanced, and had no conception of the awful nature of his crime, for which he atoned with his own life.

His Family. Two of Garfield's sons achieved distinction in several fields. HARRY AUGUSTUS GARFIELD (born 1863) was a prominent Cleveland lawyer, professor at Western Reserve University and at Princeton University, and since 1908 has been president of Williams College, his own and his father's *alma mater*. JAMES RUDOLPH GARFIELD (born 1865) also studied law, was for several years commissioner of corporations in the Department of Commerce and Labor, and from 1907 to 1909 was Secretary of the Interior in President Roosevelt's Cabinet. W.F.Z.

Consult Thayer's *From Log Cabin to White House;* Ridpath's *The Life and Work of James A. Garfield.*

GARFIELD, N. J., a residential and manufacturing borough of Bergen County, and an important suburb of Passaic (which see). The two cities are separated by the Passaic River. Garfield is in the northeastern part of the state, twelve miles north and west of New York City and five miles by trolley southeast of Paterson. It is served by the Erie Railroad and by trolley lines to all of the near-by cities and towns. A ferry runs to 130th Street, New York, near Grant's Tomb. The borough is more than two square miles in area. The population, [illegible], was 10,213 in 1910, and 14,[illegible] estimate in 1916. [illegible]lants include woolen mills, chemical works, machine shops, rubber, knitting, embroidery and jewelry-case works, paper-box, wax-paper, clothing and cigar factories and artificial-stone works. There are more than 6,000 persons employed in these manufactories, and the value of their annual production amounts to over $16,000,000. Garfield, which received its name in honor of President Garfield, was incorporated as a borough in 1898. It is a city of many attractive residences. The public schools do not include high school courses, which are supplied by Passaic and Hasbrouck Heights. M.C.W.

GARGLE, *gahr'g'l.* When the throat becomes sore, a wash made of simple, soothing and healing medicines, called a gargle, is used to cleanse and heal the sore part. In using it, the head should be thrown well back, and some of the liquid should be churned about in the lower part of the throat. One must be careful not to swallow any of the liquid, for, even though it may contain simple drugs, the stomach may be injured. Boric acid or salt combined with water is a good disinfectant. A good gargle for sore throat is listerine, 1 part; glycerin, 1 part; and water, 1 part. Another of equal value is potassium chlorate, 1 part; glycerin, 4 parts; and water, 10 parts. If the gargles do not cure the throat quickly, it is best to consult a doctor.

GARGOYLE, *gahr' goil.* On the upper corners of many ancient cathedrals and palaces built by the Goths in the thirteenth and fourteenth centuries, were weird, half human and half animal or birdlike stone figures called

ON NOTRE DAME, PARIS

gargoyles, which served as waterspouts. These figures were made on a few buildings earlier than the period named, but they were used extensively in Gothic architecture. On the roof of Notre Dame in Paris, where they cannot be seen unless ascent is made to the top, are some of the most famous of these strange figures, but these famous "devils, of Notre Dame," as they are called, seem to have no architectural use. Modern architects use metal pipes to carry the water from the roof and very seldom add any ornament. The Univer-

sity Club building in Chicago, called the most perfect Gothic structure in America, is built with gargoyles on its upper corners, representing weird animal heads.

GARIBALDI, *gah re bahl' de,* GIUSEPPE (1807-1882), a patriot and military hero of the struggle that freed Italy from foreign rule and gave it a place among the modern nations of Europe. In his youth and early manhood he followed the life of a sailor, but at the age of twenty-six came under the influence of Giuseppe Mazzini (which see) and other young enthusiasts of the liberation movement, and he thereupon dedicated his life to that cause. Condemned to death in 1834 because of his share in an unsuccessful outbreak in Genoa, he fled to France and soon afterwards made his way to South America. There he won fame as a brilliant leader in the struggle of the new republic of Uruguay against Argentina.

GARIBALDI

In 1848 the news of the uprising of the Northern Italians against Austria brought him back to his country to give heroic but ineffectual service in a struggle that left Italy still in the hands of an oppressor. When this revolution failed, Garibaldi took refuge in Genoa, later reaching Tunis, and after that emigrating to the United States. During the next few years he revisited South America, and for a time had command of an American trading vessel on the Pacific coast. In 1854 he returned to Europe, settling on a small farm on the island of Caprera, in the Mediterranean Sea.

In 1859, when the Italians again struck for liberty under the standard of the king of Sardinia, Garibaldi began the most momentous period of his career. His brilliant and effective services of that year were continued in 1860 in a spectacular conquest of the island of Sicily, which he wrested from the king of Naples with the aid of a band of volunteers. This victory was followed by his triumphal march into the city of Naples (see SICILIES, KINGDOM OF THE TWO). In the words of an eminent historian (Myers), "The adventurous daring of the hero Garibaldi changed the kingdom of Sardinia into the kingdom of Italy." He then resigned his command to the Sardinian king, Victor Emmanuel, and retired to his island farm.

Garibaldi, however, was still far from satisfied with what had been accomplished, and his impatience to see the city of Rome again the capital of Italy led him to make two attempts to capture it. In his second invasion of the Papal States, in 1867, he was defeated by French troops who came to the aid of the Pope, and was made a prisoner. Later he was permitted to return to his island home.

On the outbreak of the Franco-German War in 1870 he took command of a company of French volunteers in Burgundy, and at the end of the war was elected a member of the French Assembly. Meantime he saw the fufilment of his hopes in the complete unification of Italy, with the Eternal City the national seat of government (see ITALY, subtitle *History*). He performed his last public service as a member of the Italian Parliament, to which he was elected in 1874. See, also, VICTOR EMMANUEL II.

Consult Henty's *Out with Garibaldi;* Trevelyan's *Garibaldi and the Making of Italy.*

GARLAND, HAMLIN (1860-), an American novelist and poet, whose realistic pictures of Western life present a different West from the romantic country of lawlessness and picturesque wildness about which so many authors have written. His stories are of the new West, an empire that was carved slowly out of the American wilderness.

HAMLIN GARLAND

Main-Traveled Roads is a book of six Mississippi Valley stories, written in Garland's happiest style. His volume of twelve essays, entitled *Crumbling Idols,* deals chiefly with literature, painting and the drama. The story *Up the Coule* has been described by critics as a "little picture worthy of Millet"—a story centered around a farm in a valley.

Garland took an active part in the experiences he recounts. When he was ten years old he plowed seventy acres of land. Half of his early life was spent on horseback and in

the meadows. Many recollections of his days on the farm are found in the volume of verse entitled *Prairie Songs*. *Harpers Weekly* published his first poem, *Lost in the Norther*, and paid him $25.00 for it. *Cavanagh*, one of his latest books, is a novel dealing with the conservation of forests. The introduction was written by Gifford Pinchot, one of America's chief advocates of conservation.

Hamlin Garland was born in the LaCrosse Valley in Wisconsin, in September, 1860. When he was seven years old his parents moved to Winneshiek County, Iowa, and it was there that the author got his first vivid impressions of Nature. Among his novels not named above are *The Rose of Dutcher's Coolly*, *The Eagle's Heart* and *Captain of the Gray Horse Troop*. Besides his novels, verses and criticisms, his sympathetic biography of Ulysses S. Grant occupies a prominent place in literature. Mr. Garland married Miss Zuleme Taft of Chicago, who has achieved some fame as a sculptor.

GARLIC, *gar'lik*, is a well-known seasoning with many valuable properties, but its strong, penetrating odor makes its wide use undesirable, and it has no food value. In Spain and among the Italians it forms a part of almost every dish. Like the onion, garlic is very easy to cultivate and is raised from the smaller edible bulbs, or *cloves*. The leaves of the plant are grasslike, like those of the onion, only not hollow. The stem grows about two feet high and bears white flowers. Wild garlic, sometimes called wild onion, is a pink-flowered pest in pastures in Eastern America, for it imparts a very disagreeable flavor and odor to dairy products.

GARLIC
As offered for sale.

Garlic has been used from the earliest times. It is mentioned in the Old Testament as being part of the food furnished the builders of the Pyramids. The juice of the garlic is also used as a cement for mending glass.

GARNEAU, *gar no'*, FRANÇOIS XAVIER (1809-[illegible]), French-Canadian historian, the author of one of the standard histories of Canada. He was born in the city of Quebec, attended the Quebec Seminary, and from 1844 to 1864 was clerk of the local municipal council. His history of Canada, though it had an immense success when it first appeared in 1845, is occasionally marred by lack of sufficient data and is throughout a defense of the French-Canadians rather than an impartial account of the past. Yet its distinction of style has made it live, and if for nothing else it is important as the first great attempt in literature to stimulate racial self-respect among the French-Canadians. Garneau's son, Alfred (1836-1904), is remembered for a volume of poems remarkable both for form and for delicacy of feeling.

In 1917 his history of Canada was being edited and revised by his grandson, Hector Garneau, chief librarian of the new library at Montreal. G.H.L.

GAR'NET, a beautiful semi-precious stone which usually shades from deep red into brown or black, although some varieties are yellow and brilliant green. Dana, an authority on minerals, divides the different varieties of garnets into three groups, according to their composition; these are aluminum garnets, iron garnets and calcium-chromium garnets. In the first class are the brilliant, deep-red stones, called pyropes, or Bohemian garnets, which were first found in Bohemia, but now come from the Kimberley mines in South Africa and from parts of New Mexico and Arizona, where they are misnamed "Arizona rubies." The almandite, or common red garnet, belongs in this class, too, and is found in parts of North Carolina and Idaho and in India. These two, the pyrope and the almandite, the birthstones of January, are the red garnets used in jewelry, and are the most valuable, being worth about two dollars a carat.

Many of the iron garnets are yellow shading into brown, red or green, and are found in numerous mountain ranges. The calcium-chromium garnets, which are emerald-green in color, are found in Siberia and some parts of Canada. Some varieties are not as hard as quartz, while others are much harder. They are found in slates, granite and limestone, and sometimes in lava beds.

The ordinary garnets, which are of little value, are frequently ground and used in polishing and cutting other stones, while crushed garnets are sometimes used instead of sand in making sandpaper. About 4,000 tons of garnets of low quality are mined in New York

state every year to be used in shoe factories for rubbing and polishing. Excellent imitations of the valuable garnet are made in Switzerland, Germany and France from a peculiar kind of glass called *strass*, or paste, and purple of Cassius.

GAR'NISHMENT, a legal notice in the nature of an attachment or execution by means of which credits, property or effects of a debtor in the hands of a third party may be held for payment of debts. A case of garnishment differs from a writ of attachment or execution in two particulars: no actual possession of the property in the hands of the garnishee is taken, and as a rule no specific lien is acquired upon the property or credits in the hands of the garnishee. It is commonly used for attaching the wages of a debtor to secure payment of a debt.

GARONNE, *ga rohn'*, the most important river of Southern France. It rises in the Val d'Aran, on the Spanish side of the Pyrenees, and flows in a northwesterly direction, emptying into the Atlantic Ocean after a course of about 400 miles. A few miles below Bordeaux, the most important town on its banks, it is joined by the Dordogne, the two streams forming the estuary called the Gironde. Ocean-going steamers navigate inland to Bordeaux, seventy miles from the sea. Smaller vessels reach Toulouse, where the Canal du Midi joins the Garonne and connects the Atlantic Ocean and Mediterranean Sea. The Garonne has thirty-two tributaries, drains an area of 38,000 square miles, and with its tributaries affords a commercial highway extending over 1,400 miles.

GARRICK, *gair'ik,* DAVID (1717-1779), the foremost of English actors, for a long time manager of Drury Lane Theater, London, and the author of numerous comedies. He studied for a time under the distinguished Samuel Johnson, and then studied law, but later his dramatic instinct asserted itself, and in 1741 he made his first theatrical appearance, in the character of Richard III. A notable success was achieved, and his fame as an actor was established. He was a Shakespearean enthusiast and in a large measure was responsible for the revival of Shakespeare's plays in their original form. His last appearance was on June 10, 1776, in *The Wonder.* He died in London three years later, and was buried under the Shakespeare monument in Westminster Abbey. Garrick's acting was distinguished by versatility and naturalness, the latter quality being distinctly opposed to the method of the period. His literary ability was not pronounced, although one of his farces, *The Lying Valet,* was very successful.

GARRISON, *gair'i son,* WILLIAM LLOYD (1805-1879), an American reformer and journalist, and founder of *The Liberator,* a newspaper that became famous as an opponent of slavery. He was born at Newburyport, Mass. His father was a sea captain who had deserted his family, and his mother became a nurse in order to support her children. In 1818 he entered the office of the Newburyport *Herald* as compositor. After his apprenticeship ended he became proprietor and editor of the *Free Press,* a short-lived paper in which the poems of Whittier, then unknown to fame, appeared. In 1828 he went to Boston and there met Benjamin Lundy, who was publishing in Baltimore the *Genius of Universal Emancipation,* a weekly periodical devoted to the cause of the abolition of slavery. Young Garrison was immediately won to the cause and joined Lundy, but against Lundy's wishes he urged immediate emancipation for slaves and the partnership was dissolved.

WILLIAM LLOYD GARRISON

He then returned to Boston and set up his own press, on which, New Year's Day, 1831, he issued the first copy of *The Liberator.* He was without money or influence, and was editor, typesetter, proofreader and distributor of the paper.

In a small chamber, friendless and unseen,
Toiled o'er his types one poor unlearned young man.
The place was dark, unfurnitured and mean,
Yet there the freedom of a race began.

Such was the tribute paid to him by the poet Lowell after reading *The Liberator,* in which the editor said, "I will be as hard as truth and as uncompromising as justice." From this time he was the leader of the anti-slavery agitation, but refused to take any part in politics. *The Liberator* soon attracted attention alike in the North and in the South. Hundreds of people threatened his life, and he was finally indicted for sedition and on October

21, 1835, was dragged through the streets of Boston and lodged in jail for his own safety. He visited Great Britain in 1833 in the furtherance of his crusade; and in 1865, after the total abolition of slavery in the United States, he was presented by his friends with the sum of $30,000 as a national testimonial. A bronze statue has been erected in Boston in his honor.

GARROTE, *ga rote'*, or *ga rot'*. In Spain and Portugal in former days people condemned to die were dressed in black and attended by a procession of priests were conducted to a public place of execution. After a criminal was seated, an iron collar, called a garrote, which was fastened to an upright post behind him, was placed on his neck and tightened by a screw until he was strangled. This was a very painful and inhuman punishment, for the man who screwed the collar did not always do it rapidly enough to kill the victim quickly. This revolting method is employed very little at present, for life sentence in chains is succeeding it in those countries as the penalty for murder.

GARTER, ORDER OF THE. In 1349 King Edward III of England established this Order of knighthood, which has become the most famous in Europe. The story is told that while the king was dancing with the Countess of Salisbury at a great court ball she lost her garter, and as he picked it up to hand to her he saw several persons smile and indulge in remarks. This made him angry, and he exclaimed in French, "Shame to him who evil

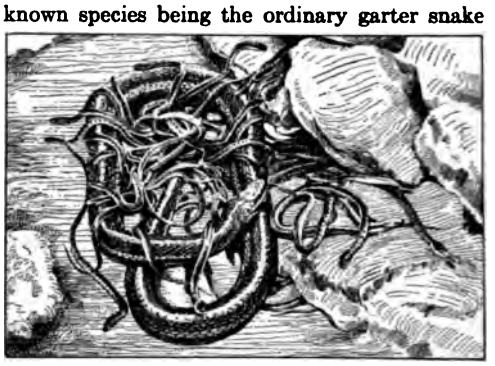
INSIGNIA OF THE ORDER

(*a*) The Garter; (*b*) the Star, worn on breast.

thinks." Then he added that he would make the little blue garter "so glorious that everyone would wish to wear it." Whether or not the story is true, the Order was founded, and only twenty-five members besides the king were at first admitted.

The emblem of the Order is a dark blue ribbon in gold, on which are printed the words the king spoke, *Honi soit qui mal y pense*. The garter is worn on the left leg below the knee, on all ceremonial occasions. After the Order was reorganized in 1831, the membership was increased by including the Prince of Wales and descendants of George I and any foreign rulers who might be selected. There were several patron saints of the Order, but Saint George was considered the special patron, so the name, "The Order of Saint George," is a term sometimes used to refer to the Order. Recently the membership has numbered about fifty.

GARTER SNAKE, a general term which is applied to various small serpents, the best-known species being the ordinary garter snake



GARTER SNAKE AND FAMILY

found in the United States, Southern Canada and the lowlands of Mexico and Guatemala. The length of the adult snake is about three feet, of which from one-fourth to one-fifth belongs to the tail. The coloring varies in different localities. Although its bite is harmless, it will assume a threatening pose when attacked. Its strength and courage make it a successful adversary of many small animals whose superior size would seem to give them the advantage. It is partial to grassy places and the borders of streams where mice, toads and fish abound. The young are produced alive, from ten to twenty at a time, and are carefully guarded, the mother allowing some of them to enter her mouth for protection when threatened by danger.

GARY, *ga'ri*, ELBERT HENRY (1846-), formerly a judge of the state courts of Illinois, later head of the United States Steel Corporation and of the International Steel Association, America's greatest industrial group.

When he was corporation counsel of the city of Chicago and president of the Chicago Bar Association he helped to organize the Federal Steel Company, a two-hundred-million-dollar merger, and became its president. A few years

later, when the so-called "steel trust" was organized, there were many disputes among the large stockholders. The Carnegie and Frick interests were particularly antagonistic, and J. P. Morgan, the great organizer, wanted for the executive a man who was not identified with either faction. Gary, of the Federal Steel Company, was not opposing anybody; he was therefore selected to head the gigantic steel merger, which was named the United States Steel Corporation (which see).

ELBERT H. GARY
Head of the greatest steel company in the world, whose output exceeds yearly the combined production of all the steel companies of Europe.

Judge Gary takes the non-militant idea of industry. He believes in coöperation, not only as between capital and labor, but as between corporations and public interests. His first big problem was with regard to the attitude of the Steel Corporation towards its employees. His solution was to invite the employees to become stockholders. Stock was offered them on easy terms of payment at less than the market prices; about 23,000 responded immediately, and the number steadily increased.

When a boy he lived on a farm near Wheaton, Ill., and attended a country school. Later he attended Wheaton College and the University of Chicago, and at the age of twenty-one began practicing law in Wheaton. When the village became a city Gary was elected its first mayor. At thirty-six he became a county judge, later moved to Chicago and at forty-seven was elected president of the Chicago Bar Association.

It has been said of Judge Gary that he is not a mere captain of industry; he is called a statesman of industry. Gary, Indiana, "the steel city" founded by the United States Steel Corporation, was named for him.

GARY, IND., a city of Lake County, the greatest steel-manufacturing center in the world. It is twenty-nine miles southeast of Chicago, on the southern shore of Lake Michigan, and on the New York Central; the Michigan Central; the Pennsylvania; the Wabash, and the Baltimore & Ohio railroads. The Elgin, Joliet & Eastern and other belt lines connect these roads with each other and with all others entering Chicago. There is also electric service between Gary and Chicago. The population in 1910 was 16,802; in 1916 the city claimed 40,000. Sixty per cent of the inhabitants are foreigners, among whom thirty-four nationalities are represented. The area of the city in 1916 was over twenty-one square miles.

Gary was created in 1906 by the building of the main plant of the Indiana Steel Company, of the United States Steel Corporation. The site offers the unexcelled advantages of a fine harbor, the rail- and water-shipping facilities of Chicago and a central location between the great iron ore region of the north and the inexhaustible coal supply of the south. The greatest steel markets of the world are close at hand; Chicago, one of the largest, is also the nearest. Other giant subsidiary plants in operation are the American Bridge Company, the Universal Portland Cement Company, the American Sheet and Tin Plate Company and the Coke By-Products Company. A huge branch of the Baldwin Locomotive Works was in course of construction in 1917. The Gary Screw and Bolt Works was one of the first independent plants to be erected here. Among other projected industrial establishments are those of the American Locomotive Works, the American Car and Foundry Company and the National Tube Company.

The educational activities of Gary are as unique as the industrial (see GARY SCHOOL SYSTEM), and the school and other public buildings are in keeping with the promise of the city. Among these are a $250,000 Y. M. C. A. building, the Gary-Carnegie Public Library, Mercy Hospital, the city hall and a number of handsome churches, banks and hotels. Gas from the blast furnaces and coke ovens is converted into light and heat for the city. The water plant, owned by the United States Steel Corporation, supplies water from two miles out in Lake Michigan. The city contains two parks, Jackson and Jefferson.

Until 1906 the location of Gary consisted of sand dunes and marshes. In that year the city was chartered and the Steel Corporation began the building of sewers and of mains and conduits for the distribution of water, gas and electricity. The city was named in honor of Elbert Henry Gary (which see).

GARY SCHOOL SYSTEM. Under the leadership of Superintendent William Wirt, a school

system has been developed in the "Steel City" of Gary, Indiana, which has attracted widespread attention. Important features of this system have been incorporated into the schools of other cities, notably in New York City, where several public schools have been reorganized under the personal direction of Superintendent Wirt, who gave one-fourth of his time to the New York work for two years.

The school program, of which Superintendent Wirt has elaborated nearly fifty variations since about 1903, is intended for what he calls the "Work-Study-and-Play School." The several factors in such a school program admit of combination in numerous ways, and he has never tried to design a program for use in all schools regardless of the varying conditions under which schools are located. He states that he has had only two fixed principles since he began the formulation of such programs at Bluffton, Indiana, in 1900. These principles are as follows:

> First: All children should be busy all day long at work-study-and-play, under right conditions.
>
> Second: Cities can finance an adequate work-study-and-play program for all children only when all the facilities of the entire community for the work-study-and-play of children are properly coördinated, with the school as the coördinating agent, so that all facilities supplement each other and the peak loads are avoided by keeping all facilities in use all of the time.

Just what children should do when at work, study or play; how they should do these things; when and where they should do them; what facilities should be provided or utilized for these purposes; and the amount of time to be given to them, may vary according to conditions in each city and in each school district within a city. With these things in mind we need only describe the "Gary Plan" as organized and operated under conditions which are more or less typical or ideal; remembering, also, that the system is conducted upon an efficiency basis intended to provide more time for children with less cost *per capita* for instruction, buildings and equipment.

A large school managed in accordance with this plan calls for a program which is too complex to be easily described or understood, so we will illustrate the technique of procedure by supposing a relatively-small school conducted in harmony with the essential principles of the system.

A School of the Gary Type. Let us suppose a school consisting of the eight grades with which all are familiar. Suppose, further, that each of the grades is divided into two sections, commonly known as "A" and "B." We have, in such a case, essentially two schools, and we may speak of them as such—the one consisting of the "A" sections and the other of the "B" sections of each grade.

To accommodate these two schools there would be needed a building with eight regular classrooms and eight or more other places for the accommodation of sections of pupils, such as are provided in auditoriums, gymnasiums, swimming pools, playgrounds, playrooms, laboratories, libraries, shops, etc. While the one school is occupied with the regular studies in the eight regular classrooms the other school is engaged in various special activities which are now included in the modern school program and which are conducted in such spaces as those mentioned, suitably equipped. The two schools alternate throughout an eight-hour day, exchanging places each hour, let us say, in the pursuit of a program made up of work-study-and-play. In the middle of the day one school is at luncheon while the other is occupied with either the regular studies or the special activities, the conditions being reversed the hour following. Spacious corridors are provided with lockers where each pupil keeps his personal belongings, and each teacher conducts the work of a department and teaches different grades throughout the day instead of teaching all subjects to a given grade of which she is in charge all day long.

In a typical work-study-and-play school program arranged by Superintendent Wirt for seventy-two classes divided into two schools of thirty-six classes each, these two schools alternate between "formal drill," "application departments" and "general work," each school giving two, two, and four of the eight daily periods, respectively, to the exercises classified under these heads. This program calls for sixty-four teachers for the seventy-two classes. Fifty-four teachers conduct work with the seventy-two classes in forty-three different classrooms, and ten teachers are required for the auditorium, playrooms or playgrounds, and library. In the ordinary school as many teachers as classes would be necessary, not counting numerous special supervisors.

The possibilities of such a program in congested centers of population where large numbers of pupils can be kept in school only part of the time, are easily apparent. This is one of the reasons why New York City, where the part-time problem has baffled solution so long,

was the first large city to make provision for the accommodation of duplicate schools in some buildings, operated under some such program as the above.

Ideally the "complete unit school plant," of which there should be a sufficient number to meet the needs of an entire city, should be located adjacent to or near a park, on spacious grounds to be used for playground and school-garden purposes. The building itself must be large and should contain classrooms for many classes in regular studies and an equal number, at least, of spaces properly equipped for the special activities involved in the work-study-and-play program. Pupils assigned to such a building, no matter how large the number be nor what grades may be represented, are organized into two schools which alternate in the use of the facilities provided, thus securing the maximum use of the "plant."

Thus situated and arranged, the "unit school plant" is a complete recreational as well as an educational center for a section of the city, for adults as well as children. In the daytime it may be a "complete" school, having all of the grades—kindergarten, elementary and high school. In the evening it is a "complete" center for social, recreational and continuation school purposes. On Saturdays it is a "complete" opportunity for voluntary work-study-and-play, and for pupils who need special help. In summer time it is a "complete" center for vacation school purposes.

A school program conducted in this manner furnishes many interesting possibilities. For example, one school or any number of individual members of it may come to the building an hour later in the morning than the other and remain an hour later in the afternoon. In this way each school or any number of its members may combine various out-of-school activities with the program pursued by them at the school building, such activities constituting a part of the eight hours of work-study-and-play. These out-of-school activities may be work at home, study under private teachers in some special subject, work in settlements, religious instruction in the churches, or work at any of the numerous "projects" having educational value for which the home or community furnishes a better opportunity than that to be found at the "school plant." Those members of a school who do not have such opportunities out of school are grouped into classes for any of the features of the work-study-and-play program which may be pursued by them most profitably, thus spending one hour more at the "school plant" than the others.

A "Complete Unit" School Plant. Vocational and pre-vocational training are provided for in the "complete unit school plant" by having a number of skilled workmen in charge of school shops which are engaged the year round in the equipment and repair of the school plants of the city, pupils working with them just as under an apprenticeship system. Instead of employing a large number of workmen from a dozen or fifteen different industries to put the school facilities in proper condition during the summer vacation, as is the case in other cities, the Gary school board employs a sufficient number of such workmen and keeps them continuously employed. In this way school shops, in which pupils may gain vocational insight and training, are provided at less expense than is usually entailed elsewhere for repairs. Indeed, balancing the output of these shops against the salaries of workmen and the cost of materials used, these shops are self-supporting. In some cases they are a financial asset instead of a liability, to say nothing of the educational opportunity provided. The printing shop provides work suitable for both sexes in printing, making note books, repairing and rebinding books, and the need of cuts for illustrating school publications, involving photography and photo-engraving, calls for other related lines of work. Moreover, the purchase, care and distribution of a great variety of school supplies and shop materials give experience in commercial and business methods.

As one observes the "plant" in operation he discovers that pupils are to be found in every part of it almost all of the day. Approaching the building he discovers them in the gardens or on playgrounds generously supplied with all kinds of apparatus and facilities made by pupils under the direction of workmen in charge of school shops. Many pupils are passing to and fro in the corridors, as is always the case at the brief intervals between the periods into which the day is divided. There are no cloakrooms, and since desks are used by different pupils in the evenings and on Saturdays, as well as during the regular school day, each pupil must keep up a line of communication with his locker, where he keeps the equipment needed during the varied activities throughout the day.

Much of this passing of pupils is accounted for in this way. In some rooms you find pu-

pils working at desks which are not only readily adjustable but also as readily convertible into work-benches. You may find a large group of pupils in the auditorium equipped with a stage, stereopticon, motion picture apparatus, player piano, organ, phonograph and such other furnishings as are helpful in mass instruction. Some pupils will be found in corridors where pictures, maps and specimens are on exhibition. Some are in laboratories, working, watching, "showing" or engaged in a regular class exercise. Some are engaged in drilling upon the "essentials," some are occupied with the arts and crafts, some are in the gymnasium and swimming pool, and so on.

Economic Use of School Buildings. The system provides for the more economic use of school buildings, especially where buildings are such as are necessary in the "complete unit school plant." When used in the manner described, such a building will accommodate about 2,400 pupils, instead of 1,200 when the school is conducted in the traditional way. It is obvious that a school system made up of such "complete" centers would cost less because of no duplication of expenses for sites, buildings, equipment, janitors, principals and instruction, the cost of the last-named item being materially reduced by departmentalizing the work and thus eliminating all overhead charges for special supervisors. The system also gives a better division of time between the old and new studies, the possibility of better teaching and adaptation of studies to individual pupils by reason of departmental teaching and a better use of time which pupils oftentimes, under other conditions, spend in a variety of harmful ways. The system, moreover, provides an escape from the "lock-step" system of graduation and promotion, making it possible to promote pupils by subjects instead of grades.

Such are some of the more important features of a school system in process of development in harmony with the two principles stated above—a system which seeks to bring together in a unitary way, with economy and efficiency in management, all the recreational and educational agencies of a city. W.P.B.

GAS. In some of the old books on chemistry we find the following story of the origin of the term *gas*.

The philosophers of the Middle Ages, who are now known as *alchemists*, were troubled by explosions caused by fire coming in contact with invisible contents of the vessels used in their experiments. Not understanding the cause of these explosions, they attributed them to the presence of evil spirits; in the seventeenth century a Flemish chemist applied the term *geest*, meaning *ghost* or *spirit*, to those invisible vapors, and from this we derive the word *gas*.

All matter exists under one of three forms—solid, liquid or gaseous, the most elusive of all. Many gases, as oxygen, hydrogen, nitrogen and carbon dioxide, possess neither color nor odor, and we can detect them only by their effect upon us or upon some substance placed in them. For instance, if a lighted candle is placed in a jar containing carbon dioxide the flame will be extinguished. On the other hand, if we fasten a lighted match to the end of a fine steel wire or the mainspring of a watch and place them in a jar containing oxygen, the wire or the watch spring will burn and throw off brilliant sparks. For these and other reasons the chemist feels as sure that these and other gases exist as that wood and stone exist, and by observations and experiments he has learned a great deal about these unseen substances.

Air is the gas with which people are most familiar. It was by studying air that learned men obtained many hints as to the habits of other gases. They discovered that gas shares certain properties with other kinds of matter. Although it is often invisible, tasteless and without smell, gas can easily be shown to have weight. It is the pressure of the air, for example, that sustains the column of mercury in the tube of a barometer. Everybody has experienced the push of the atmosphere when the wind blows; it often exerts a force so enormous as to level forests and sweep the masts from ships upon the sea. As compared with liquid or solid substances, the weight of a gas is, of course, quite small; water, for example, weighs nearly 800 times as much as air; and air, again, is about fourteen and a half times as heavy as hydrogen, the lightest known gas.

Early scientists thought of gas as a substance that never lost its airlike quality; it remained for Faraday, in the years 1823 to 1845, to show that this is not true. By applying cold and pressure he reduced most of the common gases to a liquid state. In 1869 Andrews showed that carbonic-acid gas cannot be liquefied if its temperature is above 88° F. (31° C.), but that only a moderate pressure is necessary to liquefy it at or below that temperature. It

has since been found that for each gas there is a similar *critical temperature,* above which it cannot be liquefied, however great the pressure applied. This accounts for the failure of Faraday and others to liquefy oxygen, nitrogen, hydrogen and carbon monoxide. All gases have since been liquefied (see LIQUID AIR), and this suggests that gas is more like a liquid than a solid, which is true. Both are known to the scientist as *fluids;* that is, both *flow* and are essentially formless, since they will assume any form.

Unlike a liquid, however, gas expands readily to occupy fully any space, however large. To get an idea of the habit of a gas, one may think of its ultimate particles, or molecules, as exceedingly small rubber balls in constant and violent motion. These molecules, so infinitely small that a volume of gas as large as the head of a pin would contain thirty million times as many molecules as there are people on the globe, fly hither and thither in space, jostling one another and striking and rebounding from the sides of any vessel or room that contains them. They deliver a bombardment of tiny blows, which results in the phenomenon we call gaseous pressure. This is the conception of the nature of gases which is commonly accepted among scientists. It is called "kinetic theory" of gases.

Boyle's Law. A seventeenth-century natural philosopher, Robert Boyle, noticed that when gas was compressed into a smaller space the pressure was increased. He announced that if the temperature of a gas remains constant, the smaller the space the greater the pressure. The pressure, moreover, is in direct proportion to the density; that is, when the external pressure is increased four times, the gas is forced to occupy one-fourth of its original space. It is easy to see why this is so, since the same number of molecules, confined in a narrower space, would deliver their blows against the sides more frequently.

Heat has a surprising effect on gas. It imparts energy to the molecules and causes them to deliver their blows with greater rapidity. This naturally results in a greater pressure in a vessel of the same size; if the walls are movable, the gas will push them out. Thus we say gas expands with heat, just as do nearly all other substances.

Charles's Law. A Frenchman named Charles reduced this truth to law by announcing that as long as the pressure remains the same the space filled by the gas will be increased by a constant fraction of its original volume for each degree of rise in temperature.

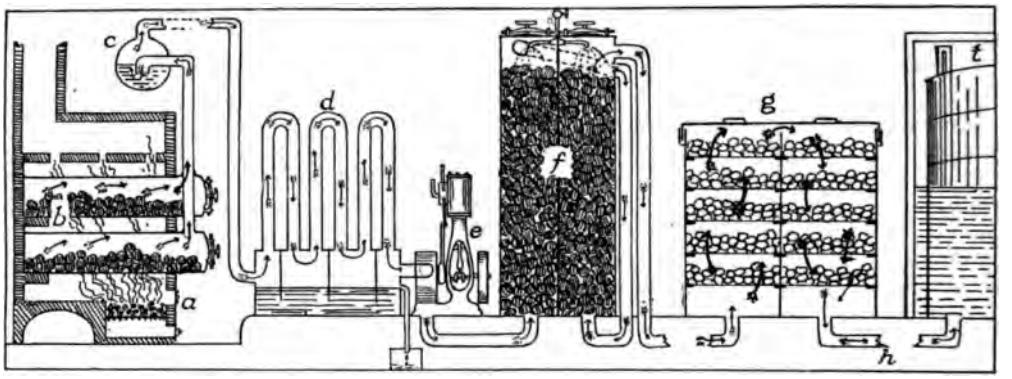
All gases obey these two laws with a fair degree of accuracy.

Illuminating Gas

Since coal in burning gives off flames, it hardly seems surprising that it should be made to yield a luminous gas. It was not, however, until the close of the eighteenth century that a Scotchman, William Murdock, showed in the most conclusive way that an inflammable gas could be extracted from coal. He succeeded in lighting his home and his office in Redruth, Cornwall, England, with such gas. After that it was not long until coal gas began to be manufactured in large quantities for lighting streets and houses. At the present time it is manufactured chiefly from coal but sometimes from oils derived from petroleum.

Coal Gas. Coal gas is formed by the distillation of coal. This is a rather complicated process, and it is carried out in huge gas plants. It may not be easy to understand at first how a solid can be distilled, and indeed the process is not exactly distillation in the same sense as we speak of the distillation of water or whisky. What is really done is to decompose the coal into gas and coke, a form of carbon. It is easy to imitate the manufacture of coal gas. Take a clay pipe and fill the bowl with soft coal; stop the mouth of the bowl with clay and allow it to dry well. Blow gently into the pipe to make sure that it is tightly closed by the clay. Then thrust the bowl into a fire. In a short time gas will issue from the stem, and if a match is touched to this gas, it will burn. Such crudely-manufactured gas is full of impurities, but still it is gas. When freed from impurities, it becomes the gas we burn in jet or fireplace.

The first process in making gas is to heat coal in fire-clay retorts. The retorts are oval or D-shaped in cross section. They are about nine feet long and 16x26 inches across the end, and they will hold from 250 to 350 pounds of coal. After charging they are tightly closed and heated in a furnace. In these retorts the carbon compounds of the coal are decomposed. The coke left in the retorts is used as a fuel or for the manufacture of carbons for electric arc lights. The gas passes off through a pipe, the



APPARATUS FOR THE MANUFACTURE OF COAL GAS

(*a*) Furnace; (*b*) retorts containing coal; (*c*) hydraulic *main;* (*d*) condenser; (*e*) exhauster; (*f*) scrubber; (*g*) purifier; (*h*) pipe leading to storage tank.

only exit from the retorts. Gas at this stage of its manufacture contains many impurities, such as tar, sulphur, ammonia, carbon dioxide and water vapor. The rest of the process is largely one of purification.

The gas leaves the retort and passes to a large U-shaped pipe containing water. In passing through the water, it is freed of much of its tar and ammonia. It is next forced by a rotary pump into a tar extractor, where more tar is removed at a temperature of about 100° F. The gas then passes to what is called the condenser. The condenser is built something like a tubular boiler; the gas passes through a set of tubes in one direction while water flows in the opposite direction outside the tubes. The gas is then forced by the exhauster (see diagram above) into contact in the scrubber with water in a cylinder containing coke, gratings of boards or other porous material. In the scrubber, more tar and ammonia are washed out, and the gas is then ready for the purifier. Here it passes through layers of lime or of oxide of iron, and loses any sulphur which it may contain. After this process it is ready for use, and is stored in huge tanks.

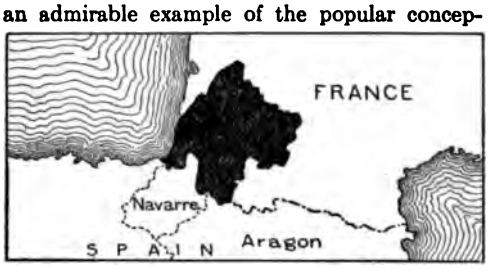
Water Gas. Water gas, which is now used in many cities, is made by passing steam over red-hot coke or anthracite (hard coal). This gas consists of hydrogen and carbon monoxide. It burns with a very hot blue flame. In order to render it useful for illuminating purposes, it must be "enriched" with gases that burn with a yellow flame. Frequently it is mixed with coal gas. Sometimes it is enriched by adding volatile liquids derived from coal or from petroleum. On account of the large proportion of carbon monoxide it contains, water gas is extremely poisonous, much more poisonous than coal gas.

Other Gases. Other illuminating gases are acetylene (which see); Pintsch, or oil, gas, made from petroleum, and used in lighting railway cars; Blau gas, also made from petroleum; and gasoline gas, made by vaporizing gasoline in a current of air. J.F.S.

GAS CLOUDS, in warfare, are designed to render the enemy helpless before an attack. In April, 1915, Canadian and French troops in the War of the Nations were surprised to see a heavy, greenish cloud creeping toward them along the ground at the rate of a few hundred feet a minute. From its effects the cloud is thought to have been composed of chlorine gas, of which a very small quantity produces a painful asphyxiation. Reference to the article CHLORINE will show that this gas is well suited to such a purpose, first, because of its heaviness; second, because it may be transported to the trenches in liquid form, and, third, because it is cheap. A satisfactory defense against gas clouds was found in cotton masks saturated with an alkali solution to absorb the chlorine. See WAR OF THE NATIONS.

GASCONY, *gas'ko ni,* an old province of France, north of the Pyrenees Mountains. It took its name from the Vascones, who crossed the mountains from Spain in the sixth century. They long maintained independence, but were finally subdued and ruled over by Frankish dukes. Gascony was the scene of many struggles between the French and English, who were at last driven out as a result of the victories of Joan of Arc. The Gascons were faithful and brave but much given to boasting, whence comes the word ***gasconade,***

which means to brag or bluster. Dumas gives an admirable example of the popular concep-



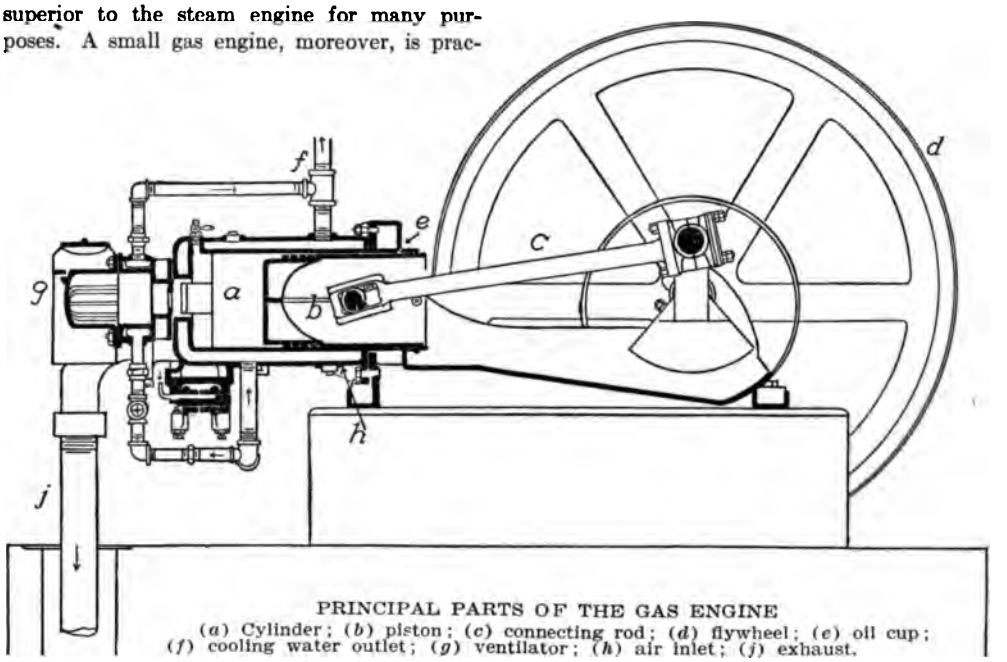
GASCONY

tion of a Gascon in D'Artagnan, the hero of *The Three Musketeers.*

GAS ENGINE, an engine in which the motive power is produced by the explosion or combustion of gas in a closed cylinder. It is also called an internal-combustion engine. Such engines have reached a high degree of development in recent years, and are used for a variety of purposes. They drive automobiles, motorcycles and motor boats; they are used in factories of many kinds, and they furnish power for churns, plows, tractors and all sorts of machinery on the farm. Their comparatively light weight and small bulk make them superior to the steam engine for many purposes. A small gas engine, moreover, is practically as efficient as a large one, whereas a small steam engine is much less efficient than a large one. A gas engine is easily operated, and is instantly ready for use. For these reasons a small gas engine is the most economical and the most satisfactory power-producer if only a small horse power is required. For large power plants other forms of power-producers may be equally or more satisfactory; this fact depends on local conditions.

Kind of Fuel. The gas used may be natural gas, coal gas, producer gas, or a vapor produced from gasoline or any other petroleum product. Engines in which gasoline is used—and these are by far the commonest variety—are usually called gasoline engines. They differ from ordinary gas engines only in that the fuel must first be vaporized by means of a carburetor (which see). In stationary engines either liquid or gas may be used as fuel. In portable engines, such as those used in automobiles and motor boats, the liquid fuels are better, for they are usually cheaper, easier to handle and easier to obtain than compressed gases in storage tanks.

The Principles of Operation. A gas engine is an internal-combustion engine, that is, the combustion occurs inside the cylinder. The first requirement of such an engine is an enclosed space, in which combustion of the gas and the resulting increase of pressure may take place. This enclosed space, or combustion chamber, is the cylinder. One wall of this air-tight, gas-tight chamber must be adjustable, in such a way that the pressure from combustion may be used to perform work. This is



PRINCIPAL PARTS OF THE GAS ENGINE
(*a*) Cylinder; (*b*) piston; (*c*) connecting rod; (*d*) flywheel; (*e*) oil cup; (*f*) cooling water outlet; (*g*) ventilator; (*h*) air inlet; (*j*) exhaust.

accomplished by having a piston fit into the cylinder. When the gas in the chamber is exploded the piston is forced outward. This outward motion of the piston is controlled by a crank shaft. The crank shaft not only determines the distance the piston goes, but is itself rotated by the force of the piston's motion, and in turn draws the piston back to its original position.

Meanwhile, the condition in the cylinder deserves attention. When the gas in the compression chamber is exploded, by means of an electric spark, the combustion instantaneously raises the temperature of the gas, a temperature of 1500° C., or over 2700° F., being not unusual. This increase in temperature is accompanied by a tremendous expansion in volume. As the gas expands, it drives forward the piston with a pressure which may be several hundred pounds to the square inch. The burnt gases then escape through valves in the compression chamber, and a new supply of gas is admitted. When the piston returns, as explained above, by the motion of the crank shaft, it compresses the new supply of gas, and the entire operation is repeated. In a two-cycle engine there is one explosion for two strokes, forward and backward, of the piston, or for each revolution of the crank shaft. In a four-cycle engine there is one explosion for four strokes or two revolutions.

How Ignition or Explosion Is Produced. In practically all modern gas engines ignition is produced by means of an electric spark. The current may come from a magneto or dynamo, or from a storage or other variety of battery. The electric spark is made to jump between terminals which are fixed in the mixture to be ignited. These terminals are usually mounted in a spark-plug, which insulates one or both of the terminals, and is so constructed that it can be easily removed and replaced if broken.

Capacity of Gas Engines. The largest single gas engine in existence furnishes 2,000 horse power in its four cylinders. Greater power than this can be obtained by a combination of additional units. The smallest gas engine made has a capacity of only a fraction of a single horse power. W.F.Z.

Consult Wimperis's *Primer of the Internal Combustion Engine;* Carpenter and Diederichs's *Internal Combustion Engine.*

GAS'KELL, ELIZABETH CLEGHORN (1810-1865), a British novelist, whose books possess an irresistible quality of charm, was born in London in 1810. Her father had been a Unitarian minister, but gave up the calling to accept the position of keeper of records of the Treasury in London. Her mother died shortly after her birth, and the girl's childhood was spent with an aunt in Knutsford, near Manchester. Knutsford is Cranford, and the volume bearing that name attests the author's knowledge of the spirit of the place. She was married to William Gaskell, a minister of Manchester, when she was twenty-two, at which time she was noted for her remarkable beauty. Twelve years after her marriage the death of her only boy turned Mrs. Gaskell's thoughts to writing as an escape from sorrow.

Her first novel, *Mary Barton,* was published in 1848. The book had as its background the unending strife between employer and employed. Its practical result was to help create a better atmosphere, which meant ultimate improvement in social conditions. Charles Dickens was so pleased with the book that he invited Mrs. Gaskell to coöperate with him in *Household Words,* and to this magazine she contributed a great many stories and sketches. Among the latter, appearing from 1851 to 1853, were the separate sketches which became the chapters of *Cranford,* and which were published in book form in 1853. It is regarded as a classic, and stands higher in popular favor to-day than any other work of Mrs. Gaskell. *Cranford* is a chronicle of bright incidents which reveal the people and embody the spirit of a little town. It has a sunny humor, a tranquil common sense and a humanity that ranges from laughter to true pathos.

In the short period between 1860 and the year of her death Mrs. Gaskell produced three other stories, *Sylvia's Lovers, Cousin Phillis,* and an unfinished novel, *Wives and Daughters,* published in two volumes in 1866. M.R.T.

GASOLINE, *gas o leen',* a highly inflammable liquid which looks like water, but is lighter and has a characteristic odor. Gasoline is one of the products of petroleum (which see). It is an exceedingly volatile liquid; that is, it evaporates rapidly on exposure to air. It cannot be kept in wooden barrels for any length of time, for no matter how cold the weather, it forces its way through wood. It must, therefore, be placed in metal receptacles, and the law requires that tanks containing it must be kept underground.

Uses. On account of the high explosive quality of suitable mixtures of gasoline gas with air, gasoline can be employed so advantageously that it has become within recent

years the most popular of all fuels for internal-combustion engines. This has been called the "gasoline age," so completely has gasoline superseded other fuels for supplying motive power for automobiles, trucks, tractors, flying machines and some forms of stationary engines. Automobiles by the millions have made such tremendous demands upon the supply that the price more than trebled in the half year between September, 1915, and March, 1916. From a rate as low as ten cents a gallon the cost to consumers advanced to over forty cents in some cities, and nowhere was it lower than twenty cents per gallon. The increase was not due to price manipulation; the supply could not keep pace with the demand, and manufacturers were called upon to devise methods for very largely increased production.

The Work It Can Perform. The power it is possible to develop from a gallon of gasoline

THE POWER OF GASOLINE TO DO WORK

Every minute that gasoline is properly employed in an internal-combustion engine it performs as much work as can be done by six horses in an equal length of time.

is one of the most remarkable developments of engineering. It will move a ton truck fourteen miles; propel a 3,000-pound automobile twelve miles, at the rate of forty miles an hour; run machinery to milk 300 cows; bale four tons of hay; plow three-fifths of an acre of land; mix thirty-five cubic yards of cement; keep eight electric lights burning for thirty hours.

How Produced. Until recent years gasoline was considered one of the waste products in the refining of petroleum. It was a by-product of kerosene; to-day kerosene is of secondary importance and is becoming a drug on the market, for the quantity of kerosene increases with the increasing production of gasoline. It is more than probable that science will some day develop ingenious methods which will give kerosene the fuel value of its by-product, for already some specially-equipped engines can use it.

To produce gasoline, petroleum is placed in a *retort*. This is a closed vessel. Through the agency of heat, gently increased during the process of refining, the petroleum is fractionally distilled into its component parts, in the order of their volatility—the lightest being separated first, and gasoline, which is not quite so light, second. From the retort the gasoline is passed through a coil of cold pipes, called a *worm*, where it is cooled; it is then passed to receiving tanks.

Recently the problem of increasing the yield of gasoline from petroleum has been successfully solved. The heavier oils left in the retort at the time the gasoline is distilled are vaporized and heated under pressure. At 500°-575° C. (930°-1070° F.) under a pressure of 250-300 pounds per square inch, good yields of gasoline are obtained. It is estimated that if these processes were generally adopted the petroleum deposits of the United States would last for over a hundred years, whereas at the present rate of production it is believed they will be exhausted in twenty-seven years. Attempts to manufacture gasoline from natural gas are also being made.

Amount of Production. The present annual production of gasoline in the United States is about one billion gallons. Of this, between thirty and forty per cent is exported. The amount produced in Canada is very small, practically all of the supply used in the Dominion being imported from the United States. Canadians get nearly twenty per cent more in every gallon than do purchasers in the United States, for in the Dominion the standard measure is the imperial gallon of 277.274 cubic inches, while in the American states the gallon is 231 cubic inches. See GAS ENGINE; AUTOMOBILE; TRACTION ENGINE. F.ST.A.

Consult V. B. Lewes's *Oil Fuel;* Butler's *Oil Fuel; Its Supply, Composition and Application.*

GASPÉ, *gas pay'*, PHILIPPE AUBERT DE (1786-1871), a Canadian novelist, author of *Les Anciens Canadiennes (The Old-Time Canadians),* an historical novel dealing with the old régime, when "seigneur, curé, censitaire and voyageur mingled in a life of feudal loyalty, religious zeal and stirring adventure." Brought

do to Cornwallis what he had accomplished against Burgoyne; in his own words, he was bent upon "Burgoyning Cornwallis." He was totally defeated by Cornwallis at Camden, however, his army was nearly annihilated, and in December he was superseded by Greene. A court of inquiry was appointed to inquire into his military conduct, but after careful investigation Greene concluded that Gates was not to blame for the disaster, and advised against holding the court. At the close of the war he retired to his estate in Virginia, and in 1790 he removed to New York where he died.

GATH. High above the plain on a hill in the Palestine of Bible times and surrounded by steep walls, stood Gath, one of the five royal cities of the Philistines. It was a hard place to capture and a very important fortress to hold. Warring nations fought to obtain possession of it and when David, Hazael and Uzziah captured it, they destroyed much of value within its gates. Gath was the home of a strong race of men, among them Goliath, who grew to manhood in this city and whom David slew. At present a small village is all that is left of the once famous city. In David's lament for Saul and Jonathan (*II Samuel* I, 20), he says, "Tell it not in Gath, publish it not in the streets of Askelon," for he fears that the daughters of the Philistines will rejoice over the death of these two great men. The expression, "Tell it not in Gath," is to-day used to mean, "Keep it secret."

GAT'LING GUN, a quick-firing machine gun, the original from which the most effective of the smaller weapons used in modern warfare have been evolved. It was invented by Richard Jordan Gatling during the War of Secession in America, and was afterwards adopted by all modern armies. The Gatling gun was practically a revolving rifle with ten barrels fired in turn. It had a capacity of 350 shots a minute, and was easily moved from place to place. Although superseded by the Maxim and other machine guns the Gatling gun possessed a few features that have not been improved. See MACHINE GUN.

Richard Jordan Gatling (1818-1903) was born in North Carolina. He showed great mechanical skill as a child and later assisted his father in perfecting a machine for sowing cotton seed. He also invented a hemp-breaking machine and a steam plow. The United States Congress voted him the sum of $40,000 to experiment in new methods of casting cannon. His greatest invention was the Gatling gun.

GAUGE, or **GAGE,** *gaje,* a mechanical appliance for registering the force of steam or the depth of water in boilers. The steam gauge consists of a metal box with a dial, over which an indicator, or needle, moves. Steam from the boiler enters a tube in which is a flat piece of metal connected with the needle by a rod and spring. The pressure of steam acts on the needle, forcing it round the dial face to indicate the pressure in pounds. Exactly the same principle is found in the ordinary spring scales used in grocery stores. A water gauge consists of a vertical glass cylinder connected with the boiler by metal tubes. The height of the water in the cylinder indicates the level of the water in the boiler.

GAUL, *gawl,* an ancient country, in the main identical with France, though larger than that country at present. Every schoolboy who begins the study of Latin becomes familiar with the name, for Caesar's famous *Commentaries*

GAUL
Boundaries at the time of the greatest extent of the Roman Empire, about A. D. 115.

opens with the oft-quoted sentence, "All Gaul is divided into three parts." Caesar then goes on to describe these three parts and the people that dwell in them, who "differ among themselves in customs, in manners and in language" —the Belgae, the Aquitani and "those who in their own language are called Celtae, in ours, Galli." Caesar was not the first of the Romans to come in contact with the Gauls. Centuries before, the Gauls, whose territory extended from the North Sea to the Alps, had crossed that mountain barrier, swept down

through Italy and sacked and burned Rome (390 B. C.). The northern part of the peninsula they continued to hold, and thus there came into existence a *Cisalpine* or "this-side-the-Alps" Gaul, as distinguished from *Transalpine* or "beyond-the-Alps" Gaul. In the third century B. C. other tribes invaded Greece and Macedonia and finally crossed into Asia Minor, where under the closely similar name of *Galatians* they long retained their race characteristics.

Even brave and warlike as they were, they were no match for the organized forces of Rome, which began to force the Gauls little by little farther and farther northward, until at last they passed out of Italy altogether or submitted and became peaceful subjects of the republic. Still they were too powerful, however, for Rome to desire them as a neighbor just beyond the Alps, and Roman invasions into Transalpine Gaul began. During the second century B. C. the Romans made themselves masters of the strip along the sea, from the Alps to the Pyrenees, but not until the time of Julius Caesar did all Gaul come under Roman sway. From 58 to 50 B. C. Caesar carried on one campaign after another, and the battles were hard-fought, for the Gauls were no unworthy adversaries. "The bravest are the Belgians," wrote Caesar, and this tribute, in its original Latin form of *Fortissimi sunt Belgae,* was the inscription chosen for the proposed monument to the Belgians during the War of the Nations. The popular name for the part of Gaul won for Rome by Caesar was "Long-haired Gaul," because the Gauls did not keep their locks shorn.

During the time of Augustus, Gaul became an integral part of the Roman Empire and was organized in four provinces; this division persisted for four centuries. Later the history of the Gauls merged in that of other peoples—the Goths, the Burgundians and the Franks; and in time, out of the conflict the modern French nation was born. A. MC C.

GAUNTLET, *gahnt'let.* In the thirteenth century knights and soldiers began to wear a heavy leather glove covered with little plates of iron to match the rest of their armor. These were called *gauntlets,* and they were used throughout the Middle Ages. We still hear people use the expression, "throw down the gauntlet," which means "declare a challenge." When a man in medieval times considered that some one had wronged him, he would at once throw his glove, or gauntlet, down before him. The enemy, if possessed of the spirit of his day, would pick it up, as it was a challenge to fight, and the two men would arrange a time for battle. The battle was regulated by

GAUNTLETS OF THE FOURTEENTH CENTURY

fixed rules and was considered a legal trial. Whoever won was thought to be in the right, for it was believed that God gave the innocent strength to defeat the guilty.

GAUR, *gowr,* or **GOUR,** a wild ox of India, supposed to be the largest existing species of wild cattle. Specimens have been found whose horns measured thirty-nine inches in length by nineteen inches at the base. This, however, exceeds the average. The gaur is shining, blackish-brown in color, with pure white lower legs. It is a most desirable object of rifle sport in India, must be stalked on foot, and when cornered is extremely ferocious. Notwithstanding its fierceness when charged, it rarely attacks human beings except in self-defense. The semicivilized hill tribes of India have tamed it to a certain extent, although it has never been fully domesticated, and they also use it for food.

GAUZE, *gawz,* a light, transparent fabric, originally made of silk, but now manufactured from linen or cotton, the characteristic feature of which is its openness of texture. The word is apparently of Eastern origin, related to the Persian *gazi,* a thin, coarse, cotton cloth; but another interesting supposition is that it takes its name from the Syrian city of Gaza, where it is said to have first been made. The open texture of gauze is due to the manner of weaving; the warp threads (those that run lengthwise of the cloth) are not only crossed

as in ordinary weaving, but are twisted in pairs alternately from left to right and from right to left, after each shot of the weft threads (those that run crosswise). In this way the weft passes through a succession of loops in the warp and the threads are kept at equal distances apart, at the same time being held firmly in place.

Gauze fabrics are plain, figured or striped. At the present time China produces many choice gauzes worked with flowers of silver or gold on a silk foundation. Cotton gauze, made especially for the use of surgeons, is valued for antiseptic purposes. Light summer under garments made from woven fabrics of silk, linen and cotton are sold under the name of gauze underwear. The term is also frequently applied to bolting-cloth, used for sifting flour, and to the fine-woven wire cloth employed in window-screens, sieves and safety lamps.

GA'VIAL, a fish-eating crocodile of Northern India, which inhabits chiefly the basins of the Ganges, Indus and Brahmaputra rivers. It is distinguished from true crocodiles by the length and slenderness of its muzzle, characteristics which vary according to age and sex. It has numerous long recurved teeth, usually more than one hundred, especially adapted to its exclusive fish diet. It reaches a great size, often twenty feet in length, but owing to its slender and weak mouth and jaws is considered less dangerous than a crocodile of smaller proportions. Its feet are webbed, and it spends much of its time in the water.

THE GAVIAL

GAVOTTE, *ga vot'*. Among the peasants in France there originated a merry, light dance which was so well thought of that it was introduced at court in the sixteenth century. It received the name from the Gavots, the people among whom it originated. At first the gavotte in 2/4 or 4/4 time, was a bright, happy dance, but later it became a stately, formal affair. As a theatrical dance it became very effective and popular, and was worked out in many ways by Glück and Grétry. As a modern dance it is not popular in society, but is seen frequently on the stage; the Russian dancer, Pavlowa, has been its greatest exponent since 1910.

GAY, JOHN (1685-1732), an English poet, famous for his *Beggar's Opera,* which was first acted in 1728. It ran for sixty-three nights, at that time a most remarkable achievement. In 1713 he published *Rural Sports,* which was followed by several pastoral poems in 1714, dedicated to Alexander Pope. This was the beginning of a lasting friendship between the two. Pope never tired of helping his friend. Gay had a great many patrons, and in 1720 he published *Poems on Several Occasions* by subscription, on which he realized £1,000, or $5,000. In 1715 his burlesque tragedy, *What d'ye Call It?* appeared, followed by *Trivia,* or *The Art of Walking the Streets of London.* A tragedy, *The Captives,* produced some years later, met with some success, and *Fables,* in verse, helped also to increase his reputation. He died in 1732 and was buried in Westminster Abbey. Pope wrote his epitaph, which is followed by a couplet of Gay's own:

> Life is a jest, and all things show it,
> I thought so once, and now I know it.

GAY-LUSSAC', JOSEPH LOUIS (1778-1850), a French chemist and physicist, and one of the most noted scientists of his day. He was an undaunted investigator of volcanic eruptions, having visited Vesuvius when it was in full eruption in 1805. He was also a fearless aeronaut, and did not hesitate to make an ascent 23,000 feet above sea level in a balloon to make observations of magnetism and also of the temperature and humidity of the air, collecting samples of air at different heights. His most important discovery was that oxygen and hydrogen unite in proportions of one to two to form water. This led to the discovery of the law of volumes, which is one of the most important discoveries ever made in chemistry.

His services to industry included his improvements in the processes for the manufacture of sulphuric acid and oxalic acid, methods of ascertaining the amount of real alkali in potash and soda by the volume of standard acid required for neutralization, and for estimating the available chlorine in bleaching powder by a solution of arsenious acid, etc. He also elaborated a method of assaying silver by a standard solution of common salt. Owing to the great benefits resulting from his experiments and discoveries, Gay-Lussac was the recipient of many honors, and in 1839 was made a peer of France.

GA'ZA, an ancient town of Syria, fifty miles southwest of Jerusalem and three miles from

the Mediterranean Sea. It is mentioned in the Bible as the scene of several of Samson's exploits. He carried away the gates of the city, and destroyed his enemies by pulling down the temple (see *Judges* XVI). The Philistines captured the city from the Egyptians and made it their chief stronghold. It was taken by Alexander the Great and later became an important Greek city. Now called Ghazzeh, it is an important commercial center with extensive manufactures of pottery and a large trade with Arabia, Persia and Egypt, carried over caravan routes. See SAMSON.

GAZELLE, *ga zel'*, a small, slender form of antelope to whose beauty, grace and gentleness frequent allusions are found in Oriental poetry. There are about twenty-three species confined to the north side of the Atlas Moun-

THE GAZELLE

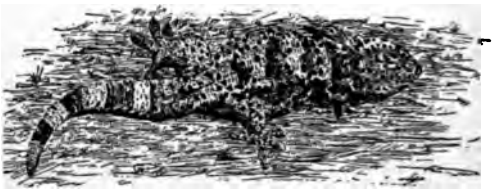
tains, Egypt, Abyssinia, Syria, Arabia and South Persia. Some inhabit mountain ranges, others sandy plains. The common light-brown gazelle of rocky and desert lands, sometimes called *ariel,* or *dorcas,* is easily tamed and is a favorite pet of wandering Arabs, the name gazelle originating from an Arabian word meaning *to be affectionate.*

Gazelles in general are animals with large, soft and lustrous black eyes and round, black horns, some ringed, others plain, and found on both sexes; the ears are long, narrow and pointed; the tail is short, and the animal has smooth, short hair. There is a tuft of hair on the knees of some species. A common species has a light fawn-colored back, deepening into dark brown in a wide band which edges the flanks and forms a line between the upper [illegible] of the body and the pure white abdomen. [illegible] are very fleet-footed and cannot be hunted by dogs. Falcons are often used for that purpose, or enclosures are made near their drinking places.

These attractive little animals feed on vegetation. A Sahara species, *Loder's gazelle,* is said to feed on berries and leaves and never to drink. *Grant's gazelle,* which stands about thirty-four inches high at the shoulder, has longer horns than any other species; the ordinary length is about ten inches, but the horns of the male Grant's gazelle reach a length of thirty inches. Another species of gazelle is the light chestnut-colored *Indian chinkara,* or *ravine deer,* of Asiatic plains. See ANTELOPE.

GEARING, *geer'ing,* a general term descriptive of mechanical appliances by means of which motion and power are communicated from one part of a machine to another. There are numerous forms of gear, the most common being cog wheels, endless belts, screws, or worm gear, friction wheels and eccentrics. Gear may be adapted to increase speed in the machinery to which the power is transmitted, or to give slower motion; these are known as *multiplying* and *retarding* gear, respectively. In *spur* gearing the teeth or cogs are arranged at regular intervals and with even depth round the surface of the wheel. *Beveled* gearing is made with the teeth running vertically on a wheel shaped like the base of a cone, and is used when shafts are at right angles to each other. Worm gear operates on the principle of the endless screw. When the gearing between two parts of the machinery is out of order, or purposely disconnected, the machine is said to be *out of gear.* It is *in gear* when connection is established. See SCREW, subhead *Endless Screw;* also, AUTOMOBILE, page 516, for explanation of gear shifting.

GECKO, *gek'o,* so called because of the peculiar cry, like *gekko,* uttered by some of the species, is a lizard of small size and repulsive



THE GECKO

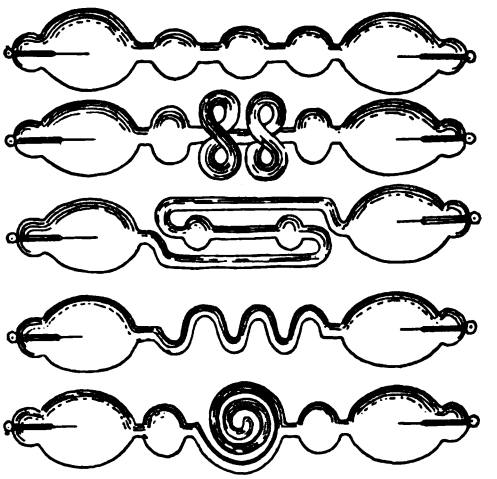
appearance. It is distinguished from other lizards by its peculiar formation, lack of eyelids, and adhesive feet which enable it to walk on a smooth wall or windowpane. It feeds

chiefly on insects, and is more or less active at night. It is found in warm climates, and is widely distributed throughout the world. It is generally regarded with disfavor as being poisonous and the carrier of disease, but there is no evidence to support such an opinion.

GEHEN'NA, the valley of Hinnom, just south of Jerusalem, where children long before the Christian Era were burned to death as offerings to Moloch. From the terrible suffering and sorrow connected with the valley, its name, which is an abbreviated form of two Hebrew words, *ge-hinnom,* meaning *valley of Hinnom,* grew to mean a place of eternal punishment, or hell. In ancient descriptions of hell the awful scenes in this valley were used as a foundation. King Josiah caused the valley to be used for sewage and other refuse, "that no man might make his son or his daughter to pass through the fire to Moloch" (*II Kings* XXIII, 10).

GEIKIE, *ge'ki,* SIR ARCHIBALD (1835-), Scottish geologist and author, considered one of the greatest geological authorities of all times. His textbooks are used both in Europe and the United States. He was born in Edinburgh, and after graduation at the University of Edinburgh became a member of the Geological Survey of Scotland, of which he was later made a director. He began his long list of works in 1858 with *The Story of a Boulder;* or, *Gleanings from the Note-Book of a Geologist.* After teaching geology and mineralogy in Edinburgh for eleven years, Geikie became director of the Museum of Practical Geology in London. He was elected president of the Geological Society of London and also became president of the British Association for the Advancement of Science. He visited America in 1897 and delivered a series of lectures at Johns Hopkins University and at McGill University in Montreal. Among his most important works are *A Textbook of Geology, Ancient Volcanoes of Britain* and *The Foundations of Geology.*

GEISSLER'S, *gys'ler's,* **TUBES,** a name given to glass tubes used to show the brilliant effect produced by electricity when it is passed through a rarefied gas. They are named after Heinrich Geissler (1814-1879), a celebrated German scientific instrument maker, by whom they were first constructed. These tubes, made of very hard glass and of different shapes (as shown in the illustration), have a platinum wire sealed into each end, which serves as an electrode. The tubes are filled with various rarefied gases, such as hydrogen, oxygen, nitrogen, air, and so on. By connecting the electrodes to the opposite poles of an electric machine or to an induction coil, an electric current is passed through the tubes. The color of the light produced depends upon the shape of the tubes, the gas with which they



VARIOUS FORMS OF GEISSLER'S TUBES

are filled and the degree of rarefaction of the gas, and by varying these conditions very pleasing effects can be obtained. Geissler's tubes are also valuable in scientific research, such as examining various incandescent gases with the spectroscope.

Related Subjects. The reader is referred to the following articles in these volumes:

Cathode Rays	Electrode
Crookes Tubes	Roentgen Rays
Electricity	Spectroscope

GELATIN, *jel'a tin,* a transparent, brittle, yellowish substance obtained from the air bladder of fish and the bones, hoofs, horns, skin and muscle of animals. When bones are made into gelatin they are treated with muriatic acid; the mineral substances dissolve and leave only the cartilage. After this has been thoroughly boiled in water it dissolves and forms a crude *gelatin* suitable only for glue. To purify it, the gelatin is again soaked in hot water and filtered, while hot, in ninety per cent alcohol, a process which causes the impurities to settle at the bottom.

The best and purest gelatin is found in the air bladder of the sturgeon and, as it is easily digested, it is used as a food for invalids. In cold water it increases to five or ten times its weight, becoming an elastic, jellylike mass.

but in hot water it always dissolves; so in the pure state, which is one kind of *isinglass*, it is used to make jellies, blanc-mange and to thicken soup. The combination of tannin with gelatin in hides changes them to leather, and it is upon this principle that the art of tanning depends. In medicine pure gelatin capsules are made to contain bitter doses, and one variety of coating on pills is the same substance.

The "sizing" which is used to stiffen silks, gauze and linen, as well as that required in paper-making and in paints, is often gelatin; it is also an important ingredient of printers' rollers. In taking impressions and casts for making models of type, and in the manufacture of certain cements and courtplaster, gelatin is used. In combination with other substances it forms the copying-pad in a variety of copying processes, such as the hectograph; it is the coating for glass plates or films used for dry-plate photography, and is an ingredient in the films for moving-picture machines. S.L.A.

GELÉE, *zhe la'*, CLAUDE (1600-1682), generally known as CLAUDE LORRAIN, after his birthplace in the village of Champagne in Lorraine. He was a celebrated French landscape painter, whose pictures were noted for the brilliant effects of light reflected in the sky, clouds and water, and for the poetic feeling shown in his interpretation of nature. He made his studies in the open field, where frequently he remained from sunrise till sunset, watching the effects of the shifting lights upon the landscape. However, his figures were not up to the standard of his other work, and so conscious was he of this deficiency that he usually engaged other artists to paint them in for him. He was wont to say that he sold his landscapes and gave away the figures.

After studying in Naples and Rome, he traveled through Germany and France and then settled in Rome for the rest of his life. In order to avoid a repetition of subjects and also to detect the counterfeit copies of his works, he made tinted outline drawings of all the pictures which he sent outside of France. On the back of each drawing he wrote the name of the purchaser. These books, six in number and called by him *Libri di Verita*, have been engraved and published and are still highly esteemed by students of the art of landscape.

Among his famous paintings are *Embarkation of Saint Ursula*, now in the National Gallery, London; *Finding of Moses*, in the Madrid Gallery; *Expulsion of Hagar and Ishmael*, at Munich; and the *Village Dance* and the *Landing of Cleopatra at Tarsus*, in the Louvre, Paris.

GELSEMIUM, *jel se'mi um*, or **YELLOW JASMINE**, *jas'min*, a climbing shrub, native of the United States, whose rootstock and rootlets yield a powerful drug called gelsemium. This shrub, with its opposite, lance-like, shining leaves and clusters of funnel-shaped, sweet-scented yellow flowers, grows near waters in rich clay soil from Virginia to Florida and Texas. There the odor of the flowers in the dampness of morning or evening is at times very noticeable.

Although the drug gelsemium is sometimes used in cases of malarial fever, rheumatism and neuralgia, it is not often used because of its dangerous qualities. A slight overdose will cause death. Drooping of the eyelids is the first symptom of too large a dose of the drug, and carbonate of ammonia, brandy, aromatic spirits of ammonia or morphine should be administered immediately. See JASMINE.

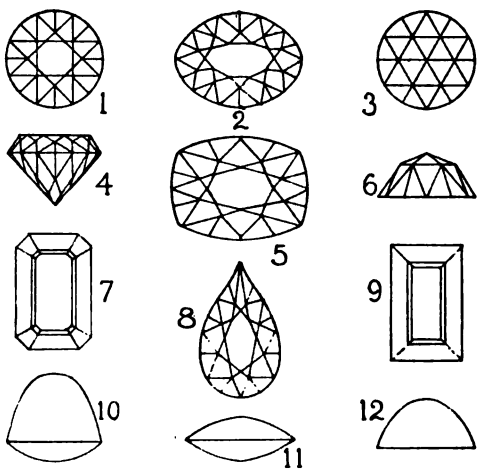
GEMINI, *jem'i ny*, or THE TWINS, in astronomy, is the name of the third sign of the zodiac, and also of a constellation now in the sign of Cancer. This constellation contains the summer solstice, the most northerly point reached by the sun. From this point it apparently commences its journey southward. The two brightest stars of the constellation are named for the twins Castor and Pollux, the sons of Jupiter and Leda. The symbol of Gemini is ♊. See ZODIAC.

GEMS, *jemz*, or **PRECIOUS STONES**, include all rare mineral crystals such as diamonds, rubies and emeralds, which, when cut and polished, are used in jewelry and ornaments. One beautiful, rare and enduring substance derived from animals, the pearl, is classed as a gem, as is also the fossil resin, amber. Coral is not a precious stone.

The word *gem* comes from the Latin *gemma*, meaning *bud*. Modest brown or dull-green buds burst forth into lovely flowers of beautiful hues, under the action of warmth and moisture and sunshine. The story of precious stones is very similar. From ugly lumps or "buds" of mineral matter, after a process of cutting and polishing, beautiful crystals are obtained which hold in their depths forever all the beautiful tints and hues which in flowers fade and die.

The value of gems is judged by their rarity, color, quality and hardness. The most valuable gems are diamonds, rubies, emeralds,

sapphires, opals and turquoises. A fine emerald often sells for more than a fine white diamond, and rubies are sometimes valued five and ten times higher than diamonds. The garnet, almandine, tourmaline, topaz, amethyst, moonstone, chrysoprase, chrysoberyl, aquamarine, heliotrope and azurite are of less value. Agate, lapis lazuli and carnelian are often cut as gems. The sources and values of the various gems are given in articles in these volumes under their individual titles. Few precious stones are produced in Canada and not more than $300,000 worth yearly are found in the



PRINCIPAL FORMS

Above are illustrated the usual forms in which gems are cut. The names by which they are designated are as follows:

(1) Round brilliant, top view
(2) Oval brilliant, top view
(3) Rose cut, top view
(4) Round brilliant, side view
(5) Cushion brilliant, side view
(6) Rose cut, side view
(7) Step cut, octagon
(8) Pear brilliant, top view
(9) Step cut, oblong
(10) High cabochon, side view
(11) Cabochon, side view
(12) Lentil-shaped, side view

United States, the most important of these being the sapphire. Over $30,000,000 worth of precious stones are imported into the United States in average years.

Although there is no doubt that brilliant stones were at first gathered for their beauty, it is also true that from earliest times gems have held definite meanings to people of all nations. Those who pretended to be learned about the stars (astrologers) believed that gems, as well as stars, influenced the lives of people, and from the first century it was believed that a special stone was dedicated to each month of the year. Even wise men and seers thought that the health and fortunes of individuals could be affected by the wearing of precious stones, and the stories of gems worn as charms are many. The study of carved and engraved gems and of precious stones set in strange designs by people of long ago brings to light many interesting beliefs and startling tales of deeds done for the mere possession of a single precious stone. Gems have also played an important part in religious superstitions, and frequently mention of precious stones is made in Scripture. The histories of kingdoms are woven about the jewels of royal families and of the nobility.

The art of engraving and carving gems held a high place among Greeks, Etruscans, Romans and Egyptians, and in modern times Italy and Germany have been the chief seats of the precious stone engraving art. Stones which have a design raised above the general surface are called *cameos;* those with the designs sunk below the surface are called *intaglios.* Some of the earliest specimens of cut gems are seen in scarabs, or beetle-shaped seals. Valuable and interesting collections of ancient gems are to be seen in museums in many of the large cities of the world, and private collections are prized by students or lovers of gems everywhere. Yet only about 10,000 really antique gems are in existence. The Morgan collection exhibited in the American Museum of Natural History, New York, is one of the largest.

Gems, Imitation and Artificial. The fascination of gems has caused an ever-insistent demand for them. Their rarity and costliness, however, make their possession impossible to many. So the jeweler's art developed into the imitation of precious stones, and chemists attempted to produce gems artificially.

Imitation of precious stones has existed since earliest times, and paste jewels, as they are called, have been so well made they cannot be told from the real by an inexperienced person. It has become a common custom for women to have paste copies made of their valuable jewels, to be worn at places where attempts at robbery might be made.

The Egyptians, who understood the art of coloring glass, made excellent imitations of the most costly precious stones known to them. Romans used powdered rock crystal in imitating gems. In the Middle Ages excellent imitations of the emerald, ruby, sapphire and topaz were produced. In modern times the basis of most imitation gems is a variety of glass known as *paste* or *strass.* This glass, which is remarkably clear and brilliant, consists of pure pow-

dered rock crystal, red lead and dry potassium carbonate. These ingredients are powdered carefully, mixed and then subjected to heat for about thirty hours. The quality of the resulting glass depends largely on the regularity of the temperature and slowness of cooling. The glass is colored to imitate precious stones by the same process used in making colored glass. This paste, uncolored, resembles the diamond, but is soft and can be scratched easily. By testing with a quartz crystal or piece of hard steel, an imitation is easily detected.

Some imitation gems are merely cheaper stones which very closely resemble the genuine. Clear quartz, white Brazilian topaz and colorless varieties of beryl, emerald and sapphire are often sold for diamonds. Colored varieties of quartz are substituted for other gems. Another form of imitation of gems is known as *doublet*. Thin pieces of genuine gems are attached to valueless backings in such a way that the entire stone seems genuine. The imitation of pearls forms an important industry. Hollow glass beads are coated on the inside with a preparation made from certain fish scales. If colored pearls are desired, dyes are added to the mixture.

Numerous attempts have been made in recent years to produce genuine gems artificially—to solve by human skill one of Mother Nature's mysteries. Diamonds, rubies, emeralds and other colored stones have been successfully made by the fusion of various substances by means of an electric furnace, and the industry has become an important one. At first the process was so expensive, and the stones produced were so small, that the experiment seemed impracticable for commercial purposes. The process was improved, however, and the manufacture of rubies, especially, was successfully accomplished in Paris. It is said that crystals weighing over forty carats and valued as high as $25,000 each have been produced. The annual output of rubies in the Paris factory is 5,000,000 carats annually, at an average cost to the manufacturer of twenty-five cents per carat.

Some Famous Gems. Among the celebrated diamonds of the world probably none has attracted more attention than the Koh-i-nur, presented to Queen Victoria by the East India Company in 1850. After being recut it weighed 102¾ carats; it is valued at $600,000. The [illegible]linan, found near Pretoria in the Trans-[illegible]eighed originally 3,024¾ carats, or 1.37 [illegible] and measured 4 inches by 2.5 inches by 1.25 inches. It was said to be worth from two and one-half to five million dollars. Since its discovery it has been cut into nine smaller stones. The Orloff, one of the most famous of the Russian crown jewels, weighs 195 carats. It was purchased in 1772 by the Empress Catharine II, who paid for it, according to the accepted story, $450,000, an annuity of $4,000, and a Russian title. There is a magnificent diamond in the Louvre, Paris, which weighs 136 carats and is valued at $2,500,000. This stone, called the Regent, is probably the finest of large brilliants.

One of the most beautiful pearls ever found is the Pelegrina, a pear-shaped stone weighing 134 grains, and described by an historian as being "as large as the largest pigeon's egg." It was presented to Philip II of Spain by a Spanish adventurer, and at the time was valued at 14,400 ducats ($28,800). This pearl was found off the island of Santa Margarita, 100 miles from San Domingo. After remaining in the possession of the Spanish royalty for many generations, it passed to a prominent Russian family.

Consult Kunz's *The Curious Lore of Precious Stones;* Wodiska's *Book of Precious Stones.*

Related Subjects. Each gem referred to in the article is described in its place in these volumes. In addition, reference to the following will add to the reader's knowledge of the topic:

Birthstones	Intaglio
Cameo	Lapidary
Glass (*Colored Glass*)	Scarab

GENDARMES, *jen darmz'*. The strength of the French army for nearly 450 years before the Revolution was in a body of heavily-armed cavalry, called *gendarmes,* which served as a bodyguard to the king. Each gendarme dressed in armor, and had five soldiers of inferior rank to wait on him. Since the Revolution the name has been applied to military police, nearly always comprising both infantry and cavalry. They are paid much higher wages than the rest of the army, from which they are picked because of their ability. Previous to the outbreak of the War of the Nations in 1914 there were 21,000 men in this service, who took care of many police matters connected with the government and were only sent into active service in case of an emergency. In time of war they keep order in the camp and on the march.

GENDER, *jen'der.* Just as living things are classed as male or female, and things without life as sexless, so in English grammar the words naming these things are said to belong

respectively to the *masculine*, the *feminine* or the *neuter gender*. *Neuter* and *gender* are derived from Latin words meaning *neither* and *kind*. Thus, gender may be defined as the property of a noun or a pronoun that indicates sex or absence of sex. It applies only to words, whereas sex applies to things.

The Simple and Logical Rule. As suggested, gender in the English language is natural—that is, determined by the sex of the object for which the word stands. All nouns or pronouns denoting the male sex are masculine: *he, man, cock, boy, king;* all words denoting the female sex are feminine: *she, woman, hen, girl, queen;* all words denoting objects without sex are neuter: *it, book, virtue, snow, knife.*

In most foreign languages gender has nothing to do with sex; it is grammatical, not natural—that is, it is governed by the form of the word. The German word for *girl (Mädchen)* is neuter in gender because it happens to have a neuter ending; *woman (Weib)* is also neuter, so that the German, as Mark Twain laughingly remarks in *A Tramp Abroad,* says, "The fishwife has dropped *its* basket of fishes." In German *fork* is feminine and *spoon* masculine, while in French both are feminine. "English stands entirely alone," says the grammarian Ramsey, "in making gender a rational and intelligible distinction." As a matter of fact, the gender of an English noun acquires real importance only when the third personal pronoun follows, for this pronoun must agree in gender with the noun to which it refers; thus, The queen was saved by *her* guard, who lost *his* own life in defending *hers.*

Gender Forms. No English noun has a distinctive neuter form, but there are some—relatively few in number—that distinguish the masculine and feminine in one of these three ways:

1. By different words for the masculine and feminine, which for convenience are usually learned in pairs; as, *husband, wife; son, daughter; bachelor, maid; monk, nun; wizard, witch; bull, cow; ram, ewe; gander, goose.*

2. By adding the suffix *ess, ine, trix* or *a* to the masculine to form the feminine. Of these endings, *ess* is the most common. This formation may or may not require some other change in the word; as, *actor, actress; duke, duchess; marquis, marchioness; prince, princess; hero, heroine; Paul, Pauline; czar, czarina; executor, executrix; sultan, sultana; signor, signora.*

3. By joining a distinguishing word to a noun of indeterminate gender (see below); as, *billy-goat; nanny-goat; he-bear; she-bear; man-servant; maid-servant.* This method, once very common, is gradually going out of use. In the case of animals, the modern tendency is to prefix the adjective *male* or *female* where necessary to distinguish; in the case of human beings, to use the masculine form for both, letting the context indicate the gender.

Common or Indeterminate Gender. Most nouns denoting living beings may refer to either sex; for example, *visitor, servant, cousin, parent, child, friend, hearer, bird, butterfly.* Such words are sometimes said to be of the *common gender*—sometimes termed the *indeterminate gender.* If such a noun in the singular is used to refer to both sexes, it is proper to follow it by the masculine pronoun, which stands for both genders; as, *Every person has a right to* HIS *own opinion*—not, to *their* own opinion, which is ungrammatical, or to *his or her* own opinion, which is cumbersome.

Special Cases. The sex is often disregarded and the pronoun *it* is used in referring to a very young child; as, *The baby dropped* ITS *ball; the child and* ITS *nurse were both ill.* Insects, small animals, and those animals with which man does not come in frequent contact are usually treated as neuter, while masculine or feminine gender is commonly assigned to the larger animals and those that mean most to man. Thus "he" is used for the dog, the cock, the horse, the elephant, the eagle; "she" for the cat and the hen; "it" for the ant, the fly, the squirrel, the rabbit. This is not, however, a hard and fast rule. When some inanimate object is spoken of as if it were alive, we have the figure of speech called *personification* (which see), things immense or sublime being treated as belonging to the male sex; those virtuous, lovely or fertile as belonging to the female sex. Thus, Shelley writes:

> How wonderful is Death!
> Death and *his* brother Sleep.

And Shakespeare pictures the dawn as a woman and the great sun as her lover:

> See how the morning opes her golden gates,
> And takes *her* farewell of the glorious sun!

The Changing Fashion. At one time distinctions of gender were considered so important in English grammar that forms like *teacheress, championess, neighboress* and the like were in everyday use. Not many years ago, in fact, *instructress, songstress* and similar feminine forms were considered good form. The present tendency is toward simplicity, and such gender terminations are being dropped as far as possible. To-day a woman writer is an author, a *poet* or an editor, not the old-fashioned

authoress, poetess or *editress*. It is just by freeing itself from distinctions of this character, based on Latin grammar, that English has developed into the wonderfully clear, compact and forceful instrument for expressing thought that is our heritage to-day. See GRAMMAR. L.M.B.

GENERAL EDUCATION BOARD, an organization chartered by Congress in 1903 to promote education in the United States. The board was created to assist in the distribution of large benevolences for educational purposes, especially those contributed by Mr. John D. Rockefeller. Through this organization assistance is given to schools of all grades, from the common school to the university, without distinction of race, sex or creed. It has been especially helpful in promoting education in the Southern states, though its activities extend to all parts of the country. The board controls about $34,000,000, the income from which is expended for educational purposes.

GENERALIZATION, *jen er al i za'shun,* the conclusion reached concerning the characteristics of a class of objects, by observing the qualities of several individuals of the class. A generalization is reached by inductive reasoning, that is, by observing particulars and drawing a general conclusion based upon these (see INDUCTIVE METHOD). For example, when similar traits are seen in many persons of the same nationality, the generalization is made that these characteristics belong to all people of that nationality. When it is observed that heat is transmitted more readily by iron, copper, steel and other metals than by wood, glass, rubber, etc., the generalization or conclusion reached is that metals are the best conductors. The term *generalization* is applied to the act of drawing the conclusion, as well as to the result of the process.

GENESEE, *jen e see',* **RIVER,** a beautiful stream flowing through Pennsylvania and New York, whose name, which is of Indian origin, means *shining valley*. It rises in the northern part of Pennsylvania, in Potter County, and follows a northward course into New York, entering Lake Ontario seven miles north of Rochester, and about 140 miles from its source. Just before the river reaches the broad and fertile valley at Mount Morris, New York, it cuts its way through a deep, narrow gorge whose perpendicular cliffs rise in some places [redacted] feet high; within this chasm it plunges [redacted] cades, one of which, Portage [redacted] high. At the city of Rochester, where the river is crossed by the Erie Canal, it forms three waterfalls which afford excellent water power. Lake vessels can navigate the Genesee for five miles of its course.

GENESIS, *jen'e sis,* which means *origination* or *coming into being,* is best known as applied to the first book of the Bible. In this book the story of the creation of the world is told, and the story of formation of the chosen nation of God, the Israelites. After the appearance of sin in the world and the subsequent separation of good from evil, the Flood was sent to punish the wicked. Then the history of the world began again with Noah and his family as the only survivors. Many years after, God called Abraham to become the father of the chosen people of Israel, and the wonderful growth of his nation is told in the remainder of the book. When the crops failed one year and the people were suffering, Jacob, the grandson of Abraham, who had become leader of the nation, led all the people into Egypt, where his son Joseph had become the prime minister. At the close of the book both Jacob and Joseph die, leaving the people still in Egypt. It is a wonderful story of the primitive growth of a nation, and the splendid story of Joseph is one of the most striking tales ever written.

GENET, *zhe neh',* EDMOND CHARLES EDOUARD (1765-1834), popularly referred to in American history as "Citizen Genet," was a French diplomat who created the first international crisis which confronted the young American republic. After being attached to the embassies at Berlin and Vienna (1779-1780) he succeeded his father as chief of the bureau of correspondence in the French Department of Foreign Affairs. In 1792 he became minister to the United States, at the time of the French Revolution. He was enthusiastically received upon his arrival at Charleston, S. C., as a representative of a people striving for liberty; his reception was the heartier because Americans had not forgotten France's contribution to the success of the Revolutionary War.

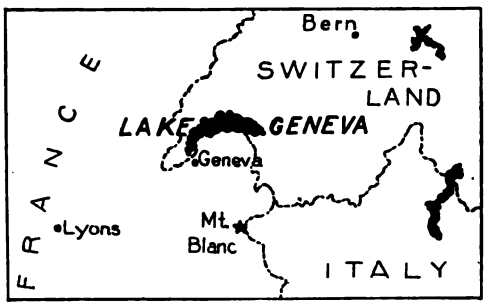
Despite President Washington's proclamation of neutrality Genet endeavored to influence public opinion to side with France. He proceeded to arm and equip privateers and raise recruits in American ports, clearly leading the United States to violate its neutrality between France and England. This, with his many imprudent criticisms of the government, compelled Washington to demand his recall in 1794. Fearing the dangers of the Revolution,

Genet did not return to France, but settled in New York City, became a naturalized citizen, and married the daughter of Governor George Clinton. See illustration, in article WASHINGTON, GEORGE.

GENEVA, *je ne' va,* distinguished as a theological, literary and scientific center, is a city of Switzerland, the capital of the Swiss canton of the same name. It is delightfully situated in full view of the Alps, at the western extremity of Lake Geneva, where the River Rhone issues and divides the town into two portions. The upper town contains the homes of its wealthy people, and many fine parks and hotels; in the lower town, which is the seat of trade, the poorer classes live. In the *Place des Alpes* is an imposing monument to Duke Charles II of Brunswick, who left 16,500,000 francs (nearly $3,300,000) to the city. Geneva is the birthplace of the writer Rousseau, the naturalists Charles Bonnet and the Pictets, the humorist Töpffer, the physicist De Saussure, and the sculptor Pradier. In 1536, when Geneva invited Calvin to make his home there, it became one of the greatest strongholds of Protestantism in Europe (see CALVIN, JOHN).

The ancient ramparts have been removed and many improvements introduced, for Geneva is one of the principal entrances for tourists into Switzerland. Its principal buildings are the Transition Cathedral of Saint Peter, dating from 1124; the town hall; the academy, founded by Calvin, with a library of 110,000 volumes and converted in 1873 into a university; the magnificent theater, ranking next in size to the Paris Opera; the Rath Museum and the Fol Museum, with collections of Greek, Roman and Etruscan antiquities; the Athenaeum, devoted to the fine arts; and the museum of natural history, containing De Saussure's geological collection. The staple manufactures are watches, clocks, musical-boxes, jewelry, gold and silver ornaments and scientific instruments; of these the city produces $10,000,000 worth annually. Population in 1910, including suburbs, 125,520.

GENEVA, LAKE, or **LAKE LEMAN,** the largest lake in Central Europe, is partly in Switzerland and partly in France. Its total area is 223 square miles, of which only eighty-three square miles belong to France. The whole of the lake is neutral territory, however, according to the terms of the Congress of Vienna (1815). The River Rhone enters the lake at the east, between Villeneuve and Saint Gingolph, and flows through the city of Geneva at the west. The lake is noted for the unusual clearness and blueness of its waters, and is surrounded by a mountainous region of great beauty. On its shores are many famous resorts, including Geneva, Lausanne, Ouchy, Vevey and Montreux. Many thousands of



LOCATION MAP

visitors annually flock to these. Near the eastern end stands the Château of Chillon, prison of Bonnivard, immortalized in poetry by Lord Byron in *The Prisoner of Chillon.* Pleasure steamers ply on the lake and a railway line runs along its northern shore from Geneva to Villeneuve. See an illustration, in article CHILLON, page 1339.

GENEVA, N. Y., a city in Ontario County, noted for its extensive nurseries and greenhouses, which cover about 10,000 acres of land. It is situated west of the geographical center of the state, at the north end of Seneca Lake and on the Seneca and Cayuga Canal, a branch of the New York State Barge Canal (which see). Rochester is fifty-two miles northwest, Syracuse is fifty-two miles northeast and Buffalo is 120 miles directly west. The city is served by the New York Central and the Lehigh Valley railways. Electric lines connect with cities east and west, and steamboats run between Geneva and Watkins, thirty-six miles distant. In 1916 a Federal estimate gave a population of 13,711, an increase of 1,223 since 1910.

The surrounding country is a rich agricultural and fruit-growing district, and some of the leading industrial establishments are dependent upon its resources. The annual output of one canning company, which employs about 500 people, is $4,500,000, and that of a cereal company is $3,000,000. Optical furnishings, cutlery, steam boilers, motor boats and stoves are among the important manufactures. Geneva is the seat of the state agricultural experiment station; of Hobart College, established in 1822 by the Protestant Episcopal de-

nomination, and of the Delancey Divinity School. Here also is located the Smith Astronomical Observatory. The post office, erected in 1906 at a cost of $100,000, a $100,000 city hall, a state armory and a $52,000 Y. M. C. A. building are the most notable buildings.

Geneva was settled in 1796 and was chartered as a city in 1898. It was named for the district of Geneva in Switzerland because of the similarity of its picturesque location to that of the European canton. The Indian village of Kanadesaga occupied a site near the present city; it was destroyed by General James Clinton in 1779. F.K.H.

GENEVA ARBITRATION. During the American War of Secession, a number of Confederate ships, notably the *Alabama,* did great damage to the commerce of the North by preying on its merchant vessels. As these Confederate ships had been fitted out in English ports and were permitted to sail therefrom, at the close of the war the United States government demanded that England pay damages for this violation of neutrality laws. On May 8, 1871, commissioners representing England and America signed the Treaty of Washington, which provided that the question of the claims against England should be decided by a board of arbitration, to meet at Geneva, Switzerland. The settlement of these claims is therefore known as the Geneva Arbitration. The tribunal, which consisted of distinguished statesmen from Switzerland, Italy and Brazil, awarded the United States damages to the amount of $15,500,000. See WASHINGTON, TREATY OF; ALABAMA, THE.

GENEVA CONVENTION, an agreement to better the condition of sick and wounded soldiers in time of war, entered into by nearly all of the nations of Europe at a conference held at Geneva, Switzerland, in 1864. The terms of the agreement, which have been accepted by every European government, by the United States and by several South American and Asiatic countries, are as follows:

(1) Ambulances and military hospitals are regarded as neutral as long as they contain sick persons.

(2) This neutrality is extended to the persons engaged in caring for the sick and wounded.

(3) The neutrality of these persons continues after the hospitals are taken by the enemy, and they must not be hindered from departing or remaining.

(4) If they depart, only their private property may be taken with them, except ambulances, which may be removed entire.

(5) A house containing a sick soldier is not to be used for the quartering of soldiers.

(6) Wounded men who are cured may return to their own country if they promise not to take up arms again during the rest of the war.

(7) Hospitals and ambulances must carry, in addition to the flag of the nation, a flag bearing a red cross on a white ground, and doctors and nurses must wear an arm badge of the same colors.

A second conference, held at Geneva in 1868, applied the principles of this agreement to war on the sea. It was then decided to declare neutral all hospital ships, merchant vessels having wounded on board, and boats picking up wounded or shipwrecked persons. These must carry the Red Cross flag, and their men must wear the arm badge. Government hospital ships must be painted white with a green stripe, and those of aid societies white with a red stripe. See RED CROSS SOCIETIES.

GENGHIS KHAN, *jen'giz kahn,* or **JENGHIS KHAN** (1162-1227), began his career at the age of fourteen years as the chief of a small Mongol tribe and soon displayed the marked military talent which made him one of the greatest conquerors in history. After much domestic warfare he subdued various Tartar revolts, and was proclaimed ruler of the united Mongol and Tartar tribes. Claiming a divine call, he so inspired his soldiers that they willingly followed him to battle. The most important episode in his career was the conquest of Northern China. After a series of lengthy campaigns, Pekin, the capital, was taken in 1215. Turkestan was next invaded, and two of its cities, Bokhara and Samarcand, were demolished.

In 1225 Genghis Khan, although then over sixty years old, attacked and conquered the king of Tangut (Southwestern China), who had harbored and refused to surrender two of his enemies. Worn with years and warfare, he then left further conquests to his sons, among whom, upon his death, his vast territorial possessions were divided.

GENII, *je'ne i,* as most commonly understood, those mysterious and fascinating spirits, familiar to every reader of the *Arabian Nights.* Some were good, assisting Aladdin to build his palace, sympathizing with the needs of humanity, and bearing a lover half across the world in the twinkling of an eye that he might look upon his loved one's face; but some were hopelessly evil, thwarting the powers of good in every possible way. A well-known example of this man-hating class is the one who threatened to kill his benefactor who had released him from the jar in which he was confined,

and was prevented only by the ruse of his deliverer in pretending to believe that he could not again squeeze his gigantic frame into the small jar. Incensed, the genie crept into it, and was promptly sealed in. These genii, or as they are also called, *jinns*, play a very prominent part in the Mohammedan religion.

Really, the word *jinns* is the proper name for the *Arabian Nights* spirits, and the term *genii* was applied to them by the translators who confused them in their minds with the genii (plural of *genius*) of the ancient Romans. To the Romans the genii were protecting deities which presided over the destinies of men. Each person had his own special genius, which led him into life, accompanied him during its course, interfered powerfully in his affairs and finally conducted him out of the world.

GENNESARET, *je nes'a ret,* LAKE OF, the former official name for the Sea of Galilee, which is described in the article GALILEE.

GENOA, *jen'o a,* popularly termed THE PROUD, is the northern gateway to the heart of Italy and one of the greatest seaports on the Mediterranean Sea. This city, with its centuries-old record of maritime glory, and of

LOCATION MAP

deathless fame as the birthplace of Columbus, is delightfully situated at the foot of the wide-circling Apennines. The slopes of the hills behind the city are covered with buildings, terraced gardens, and groves of oranges and pomegranate trees; while the summits of the loftier ranges are capped with a line of strong forts and batteries. Its fine harbors, which are equipped with modern quays and docks, welcome ships from all parts of the world. The exports, having an annual value of nearly $100,000,000, consist of cotton goods, fruits, wine, olive oil, silk goods, coral, paper, soap, macaroni and marble.

Genoa is a city of palaces, splendid in architectural beauty. Whole streets of wonderful buildings invite the visitor to their great halls, where the medieval nobility once dreamed of greatness and of war, and of the wealth that picturesque caravels brought to them from the lands beyond the seas. To Columbus, Genoa's most famous son, there is a fine monument sculptured by Canzio. Victor Emmanuel, first king of United Italy, and Mazzini, the Italian patriot, who was born in this city, are likewise honored by imposing monuments. The city is noted for many fine churches, and is well supplied with technical schools and institutions for higher education. There are also numerous philanthropic foundations, a fine library and an Academy of Fine Arts. Its Carlo Felice Theater is one of the largest in Italy.

History. Genoa was famous as a seaport under the Romans. After the breaking up of the empire of Charlemagne, it constituted itself a republic presided over by doges (see CITY STATES). From 1119 to 1284 it was almost constantly at war with Pisa, in which Genoa was finally victorious. The twelfth century marks the beginning of a long series of wars with Venice for commercial supremacy in the East. In the meantime, civil dissensions exhausted and demoralized the state, and occasioned many changes in the primitive form of government. In 1528 the disordered state regained tranquillity, which continued to the end of the eighteenth century. The form of government established was a strict aristocracy. Little by little Genoa lost all its foreign possessions. Corsica, the last of all, was ceded to France in 1768. In 1800, after the Battle of Marengo, the city was taken possession of by the French. Five years later it was formally annexed to the empire of France, and in 1815 to the kingdom of Sardinia, with which it became a portion of United Italy (see ITALY, subtitle *History*). Genoa is sixth in size among Italian cities. Population of city and suburbs, 1914, 292,130. R.D.M.

GENSERIC, *jen'ser ik* (440-477), a powerful king of the Vandals who conquered all Africa west of Carthage in A. D. 429, and finally seized the city, which he made capital of his new possessions. He then captured parts of Sicily, Sardinia and Corsica; in 455 he marched against Rome at the invitation of Eudoxia, the

widow of Valentinian, who was eager for revenge against Maximus, her husband's murderer. After two weeks of plunder he left the city with his soldiers, carrying off Eudoxia and her two daughters. At the date of his death he still was in possession of all his conquests.

GENTIAN, *jen'shan,* a flower found throughout America and Europe in moist woods and meadows. The species best known is the fringed gentian, which, through Bryant's poem *To the Fringed Gentian,* will live in the mem-

Thou blossom! bright with autumn dew,
And colour'd with the heaven's own blue,
That openest when the quiet light
Succeeds the keen and frosty night.
—BRYANT: *To the Fringed Gentian.*

In the illustration: (*a*) Fringed gentian; (*b*) bottle gentian; (*c*) solitary gentian; (*d*) downy gentian.

ory forever. It is also the flower which inspired Montgomery's *Gentianella* and Emily Dickinson's *The Fringed Gentian.* It appears in September and October, "when woods are bare and birds are flown," "an undisputed queen," growing from one to two feet high, dressed in long green leaves and fringed flowers of delicate misty blue. The blue gentian is the state flower of Wyoming.

The common yellow gentian is found in the Alps and the Pyrenees, often growing in locations 3,000 to 6,000 feet above the sea. The Alpine peasants gather the yellowish-brown bitter root of this species and sell it for flavoring bitters and for use as a tonic and in diseases of the digestive organs. Large quantities of the root are imported into the United States and Canada.

Other species of gentian found in America are the *downy gentian,* with stem rough and hairy, the *solitary gentian,* each slender stem bearing but one large bell-shaped, light-blue flower, and the *closed* or *bottle gentian,* in which the flowers never open. The gentian is said to have been named after a king of Illyria.

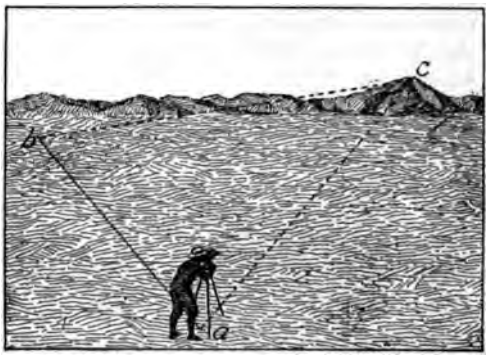
GENTILES, *jen'tylz,* in ancient times referred to all nations of the world other than the Jews, who, as the chosen people of God, considered themselves set apart for a special mission in the world. Their religion with all its truths was given to the Jews that they might be a light to the Gentiles, but, through the strict laws enacted to prevent them from becoming corrupted by association with idolaters, they soon felt contempt for the latter. Even the Christian Jews were offended when Peter, taught by the vision at Joppa, went to visit and eat with Cornelius, who was one of the hated race (*Acts* X, 28; XI, 3). However, the early Church consisted largely of Gentiles, who seemed more willing than the Jews to adopt Christianity. To-day the word has a broader meaning, for the Mormons consider as Gentiles all persons not of their faith. They include Jews in this designation.

GENUS, *je'nus.* This word, which means *kind,* is used in the biological sciences to indicate one step in classification. Animals or plants which have many characteristics in common, but do not resemble each other closely enough to be grouped as a species, may constitute a genus. The subject is more fully explained in the article CLASSIFICATION.

GEODESY, *je od'e si,* the science which treats of the shape, size and curvature of the earth. Geodesy is really a branch of surveying, by which great distances are measured and points on the earth's surface are located by a method of surveying called *triangulation.* It rests upon the principle in trigonometry that if one side and two angles of a triangle are known the other sides and angle can be computed.

Suppose scientists wished to determine the exact position of a distant mountain peak. They would first measure a base line *ab* (see illustration) on the most level tract of land in their locality, making it from five to ten miles long and measuring it several times to make sure that the distance is exact. Then they would set their surveying instrument (a theodolite) at *a* and point it to *c,* recording the

angle which the line from *a* to the summit made with *ab*. They would then take their instrument to *b* and measure in the same manner. From the length of *ab* and the angles at *a* and *b* they can readily find the length of the lines *ac* and *bc*. Again, using *ac* or *bc* for a base line, other points at various distances can be determined in like manner. The Coast and



Explanation in text.

Geodetic Survey of the United States is constantly engaged perfecting the survey of the United States, and other countries have corresponding organizations engaged in similar work. These have formed the International Geodetic Survey and are engaged upon a new map of the world, which cannot be completed before 1925. See COAST AND GEODETIC SURVEY.

GEOFFREY, *jef'ri,* **OF MONMOUTH** (about 1100 - about 1154), a Welsh historian, born at Monmouth. Little is known of his early life. He is supposed to have been a Benedictine monk, and later the bishop of Saint Asaph. The most important of his works is the *Historia Regum Britanniae* (History of the Kings of Britain); the work is said to be chiefly a translation of ancient Breton manuscripts, and gives what claims to be a history of the British kings from Brutus, the Trojan, down to 688. While it is of the greatest interest as the main foundation of the legends of *King Arthur and the Knights of the Round Table, Lear* and others, it is considered of little historic importance. Geoffrey also wrote a Latin translation of Merlin's prophecies.

GEOGRAPHICAL SOCIETIES, *je o graf'i kal so si'e tiz,* organizations devoted to obtaining and popularizing geographical knowledge. Their object is threefold; they seek to arouse in people a keener interest concerning the earth on which we live; to encourage travelers to explore regions about which little is known; and to spread this new knowledge among the general public by means of printed proceedings, and also, in most cases, by their magazines and by popular lectures by noted travelers. They assist explorers with money, supplies and practical instruction, and award medals and other honors to those who by their researches add something of value to the science of geography.

The oldest of such societies is that of France, founded in Paris in 1825. The most famous in Europe is the Royal Geographical Society of Great Britain, dating back to 1830. To this belonged Stanley and Livingstone, the great African explorers; Nansen and Markham, who voyaged in search of the North Pole, and many other travelers and scientists. The Royal Geographical Society is the active center of the exploration work carried on in the interests of the British Empire, and exploring parties under its auspices—in some cases supported by it—are at work in almost every part of the unknown world. The Danish Geographical Society, though not so well known, has accomplished much in the advancement of geographic knowledge. Similar societies exist in Germany, Russia, Scotland, Italy and other countries of Europe.

In the United States there are two large national organizations. The older is the American Geographical Society, organized in 1852, with headquarters in New York City; the second, the National Geographic Society, organized in 1888, with headquarters in Washington, D. C. The former association has been closely connected with American Arctic ex-

HOME OF NATIONAL GEOGRAPHIC SOCIETY

ploration and boasts as one of its past presidents, Robert E. Peary, the discoverer of the North Pole. Its proceedings are published in a journal called the *Bulletin.*

The National Geographic Society has the largest membership of any scientific society in the world—more than half a million—drawn

from all parts of the country, and does a splendid work in making geography popular through its annual lecture course and its widely-read publication, the *National Geographic Magazine*. The magazine makes a specialty of describing and illustrating by actual photographs not only newly-discovered territory, but any part of the world where interesting things are happening. This makes it extremely fascinating and helpful to boys and girls at school and to adults who desire to be well informed on timely topics. In tone and membership this society is much less technical than the American Geographical Society. Both organizations occupy fine buildings of their own and possess valuable collections of ancient and modern works on geographical subjects. (See illustration on preceding page.)

In some of the larger cities local geographical societies have been formed, those of Chicago, Baltimore and Philadelphia being particularly active and successful. The total number of such associations throughout the world is over a thousand. G.H.G.

GEOGRAPHY, *je og'ra fi*, is one of the most interesting of all the sciences, not only because it has so many phases, but because it touches human life at so many points. In fact, it may be called one of the few universal subjects. A man may live all his life without studying even such common subjects as spelling and grammar, for instance, but he cannot grow up without constant contact with geography. The tiny baby just learning to walk is accumulating geographic knowledge—learning which chairs are so far apart that an unaided journey between them is impossible; which tables are so placed that they offer aid to a little voyager who has set out on too long a journey. The older child learns more—where the corner candy-store is; where the fascinating ditch flows, down which toy fleets may be sailed; which side of the house has the pleasantest breeze on a hot summer afternoon. To be sure, the child does not think of all this as geography—he is simply fitting himself to his surroundings; but it is a type of the formal geography which he will study in school when he gets older.

What Geography Is. Writings about the earth—that is what geography really is; for *geo* comes from a Greek word meaning *earth*, and *graphy*, from the word *to write*. It takes but little account of what the earth was in the past, save as bygone conditions influence world facts to-day; it pays no attention to the manner in which life, whether plant or animal, came to be on the earth; it does not directly concern itself with the stars and the planets; yet it is closely related to geology, to biology and to astronomy, the sciences which make the topics mentioned above their special field, and to other sciences as well. It treats of the form of the earth, the distribution of water and land, the height of mountains and the depth of seas, the distribution of plants and animals, the qualities which fit or unfit a region to be the home of man, and the reasons, so far as may be known, why things are as they are on the earth's surface. The history of Greece, for instance, does not naturally seem to be a part of geography; but when it is understood that the history of Greece resulted largely from the geography of the little country; that a number of little independent states grew up rather than one large state because of the mountain barriers, then it may be seen how very closely the history and geography of some countries are connected. Indeed, one cannot fully understand the history of any country without a knowledge of its geography, for not only the economic development and the relation to other nations, but the national characteristics of the people, are influenced profoundly by conditions of soil, topography and climate.

It may thus be seen that geography is a very wide subject, with phases which are certain to delight any student. One student feels the romance of maps, those apparently simple

charts which make so plain to him all that has been learned about the earth through centuries of study and exploration; another reads with delight of foreign lands where customs and character are different from those of his own land; a third likes the economic phases—the study of the great industries which have grown up in different parts of the world because of varying geographic conditions; while a fourth finds especially interesting the story of the changes which wind and rain, cold and heat have worked in the surface of the earth upon which he lives. Geography tells some great story to everybody.

The Story of Geography

What the Ancients Thought of the World. Very wise were some of the ancient peoples on certain matters—so wise that in such subjects as art, literature and philosophy little advance has been made since their day; but in geographic knowledge they were woefully lacking. The small schoolboy of to-day, even the one who dislikes geography and thinks that the less he can learn of it the better, knows more about the subject than did Socrates or Plato, two of the wisest men the world has ever known.

In the first place, the ancient peoples believed, as do all primitive peoples to-day, that the earth was flat; that about it in all directions flowed a great sea, which was limited only by the canopy of the sky, bending downward to meet it. Each nation thought that its own territory lay just in the center of the earth, and many of them had legendary tales of islands which were situated far toward the sunrise or the sunset, in the uncharted seas. The seafaring Phoenicians were not content with such legendary knowledge, and pushed out into regions unknown before, bringing back to the Asiatic world real information about lands far to the westward (see PHOENICIA). Some authorities even declare that in the seventh century B. C. Phoenician navigators sailed around Africa.

The Greeks, with their young, inquiring minds—that marvelous people to whom the earth was all a wonder-world—were intensely interested in geography, and some of their wise men made very important contributions to the subject. It is a great mistake, for instance, to imagine that it was not until the days of Columbus that people knew that the earth was round, for before the time of Aristotle that fact had been conclusively established, and Aristotle himself figured the circumference of the earth at 40,000 miles. About 200 B. C. a Greek of Alexandria, Eratosthenes by name, made a far more accurate estimate, figuring out by means of measurements of the length of shadows thrown by the sun in different places that the earth was 25,000 miles around. Another Alexandrian, Ptolemy (which see), was an epoch-maker in the science of geography, discovering many principles which future study has in the main proved correct, and drawing a map of the known world which remained the standard authority for more than ten centuries.

The Age of Discovery. The people of the Middle Ages paid little attention to geography. The subject was too practical, too material, for this age, in which churchmen were the only scholars and the affairs of the Church the only subject in which they were interested. Incredible as it seems, the knowledge that the earth was a sphere was lost altogether, and the theory was developed that the earth was a flat surface, with Jerusalem as its exact center. A map of those old days is particularly fascinating. About Jerusalem as a center were spread out the known countries of the world—Persia, India, Arabia, Asia Minor, Greece, Italy, Africa; and even, far to the northwest, Great Britain. Mountains and rivers were rudely drawn, the Indian Ocean and the Mediterranean Sea wound their way between the shores, and all about the border were drawn the figures of the winds, each blowing with all his might, with distended cheeks. Shem, Ham and Japhet ornament three of the corners, and all down one side there are drawings of fabulous beings—six-handed men, centaurs, mermaids and men with necks like snakes. That map was made just about the time that Columbus started on his voyage, ushering in the modern age for the world.

Fortunately, however, Columbus did not look to such a map for guidance, but to the one made by Toscanelli according to Ptolemy's figures. There were mistakes in it, for its compiler had used the 40,000-mile estimate in making it, but this was a help rather than a hindrance to Columbus, for it made him think that the Indies, which he hoped to reach by sailing westward, were closer than they really were, and so gave him courage to set

out. It is unnecessary to give in detail all the results of that great era of exploration which began in the latter part of the fifteenth century. It is enough to say that the western hemisphere was discovered—the *New World,* as people called it in those days; that an all-water route around the south of Africa to India was discovered; and that the world was circumnavigated—the crowning achievement. Once the continents were actually known, exploration of their interiors was begun, and the outline of the American continent was put on the map of the world.

The Age of Exploration. There came a lull, when nations seemed to think more of acquiring territory and power than of acquiring knowledge; and not until the late eighteenth century did intense, driving curiosity waken again. As the late fifteenth and the sixteenth century constituted the age of discovery, so did the nineteenth century constitute the age of exploration. Not only in America but in the more dangerous wilds of Africa, of Australia and of Asia, this exploration went on, and there cannot be a correct appreciation of geography and of all that it tells without some knowledge of how this has been gained. A "dry study," children sometimes call it, and yet, back of its facts and its accurately-drawn maps there is the heroism of many men who risked and, all too frequently, lost their lives that the world might be made an open book to all who choose to read. Boys and girls who went to school in the middle of the nineteenth century, for instance, had in their geographies no such map of Africa as the textbooks of to-day show. The outline was there, but everything but the coastal region was left vague; it was called the "dark continent." Where were the sources of the great rivers that ran to the sea? What sort of peoples lived on their banks? Were there forests and mountains, or flat prairies, in the interior? What animals roamed these wilds? Nobody knew; but to-day all this information in definite form is the property of every schoolboy, because there was no lack of men who felt the romance of geography.

There were some discoveries, too, left for the nineteenth and the twentieth centuries—discoveries in the far regions about the poles. How explorers met the challenge of these ice-bound lands and seas may be learned from the article on POLAR EXPLORATION.

The Change in Geography. It might seem that, when the discoveries were made and charted on the maps, when the descriptions were written and the statistics were gathered, the work of the geographer was done; but this is not true. The gathering of such facts, apparently unrelated for the most part, was the main province of geography for centuries, but the new geography concerns itself rather with organizing these facts in accordance with certain governing principles—in other words, the new geography is a *science* in the true sense of the word. The gathering of a multitude of facts has shown that there are undoubtedly fundamental laws upon which similarities and variations rest, and the geographer exerts himself to find out these laws.

It cannot be mere chance, for instance, that all the world's greatest and most progressive nations have grown up in the temperate zone. Are the conditions which have resulted in this unchangeable? Is it hopeless ever to attempt to build up a civilization of the modern type in tropic countries where lavish nature seems able to produce everything except energy, or to populate regions of excessive cold? Can men go on for generation after generation adapting themselves to geographic surroundings, and the surroundings to themselves, without in time acquiring the characteristics of the original inhabitants of the region? Many and interesting are the problems related to human life which the geographer is called upon to solve, and it is the scientific point of view from which such questions are studied that distinguishes the new geography. J.R.

Divisions of Geography

So wide a subject as geography must of necessity be broken up into various divisions, and the most commonly accepted classification divides it into *mathematical* geography, *physical* geography, and *biogeography*. This last named division, of which the name at first appears somewhat difficult, is merely "life geography," or political geography.

Mathematical Geography. In a way, this lies at the basis of all the other phases of the subject. It treats of the shape of the earth (which is not a simple sphere, but an irregular *spheroid,* flattened at the poles, for want of a better name called *geoid*), of its size and its movements. At first thought it might seem that this is a very abstract division of geog-

raphy, having nothing much to do with the life of man on the earth; but what has a greater influence on man and his activities than the changing seasons, and do not these depend entirely on the movements of the earth among the planets? Mathematical geography is closely related to astronomy, for only by astronomical means can vast measurements be made or such complicated movements calculated. Only the simpler elements of mathematical geography are necessary to the ordinary student of the subject—only such as will give him an appreciation of distances on the earth's surface, of latitude and longitude, of the inclination of the earth which determines the various zones, and of the relation of time to longitude.

The Useful Map. One of the very important branches of mathematical geography is map-making, or, as it is more technically called, *cartography.* What is a map? It is not a picture, for the lines upon a map do not resemble very closely the objects which they represent. Time was, in the old days of map-making, when attempts were made actually to picture conditions. Rows of little hills, as accurately drawn as might be, showed where the mountains ran; a group of buildings represented a city; trees were sketched to show forest land, and even animals were shown in the wild regions. But to-day the map-maker does not need artistic skill of just this sort, for there has been an agreement as to certain symbols which shall represent certain facts. A map, then, is a *representation,* and not a picture, and it may show the entire surface of the earth or any part of it.

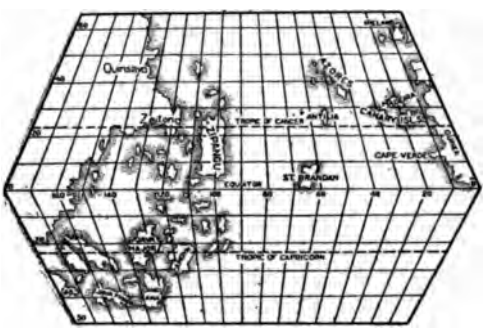
A child, asked as to what a map can show him, finds no difficulty in his reply. It shows the difference between land and sea, distinguishes one country from another, shows rivers, mountains, lakes, cities, which city is the capital of a country, and, sometimes, the relative size of cities. These are, indeed, the main things which the commonest type of map shows, but there are coming more and more into use maps which show other things. Particularly well known are the maps which show by shading the varying elevations above sea level; relief maps, they are called. Then there are those which show railroads and roads, those which show mineral productions, vegetable or animal life, or industries. Even the regions in which the various religions prevail are shown on maps. In fact, there are few great facts about the world and its inhabitants which cannot be shown more strikingly by means of maps than in any other way. No one who has ever studied maps carefully can fail to realize their appeal. There is the delight of finding the familiar home city, of tracing the course of the river which is but a little trout stream as it flows by the home farm but swells later to a mighty river, of seeing in graphic form the relative elevation of the everyday surroundings; and then there is the equally great pleasure of picking out the far-away cities whose names have always had a particular charm, of marking the course of the rivers whose names have been sounded for centuries in literature, of finding the part of the world in which great events are taking place to-day. Who, on taking a journey across the North American continent, has not felt the need of a map that he might know when he passed from one state or province to another, what river it was that ran beside the train for hours, or where the lines ran that marked the change from one system of time to another?

These things make up the romance of maps, but there is a very practical and laborious side to them. The child who draws in school a map of Illinois or of Alberta, who carefully sketches the continents, beginning with Africa or South America and coming by degrees to the intricacies of the European or North American coast line, thinks that he has "made a map"; but it is one thing thus to draw with the eyes on something which has been already perfected and an entirely different thing to work out a satisfactory method of plotting such maps in the first place.

For the earth is round and most maps are flat; therein lies the great difficulty. Slit the skin of an orange straight around, letting the cut pass through the ends or "poles," and remove it in two parts. These two hollow hemispheres may well represent the two hemispheres of the earth, or rather, their surface. Can these be flattened out on the table without further cutting? Obviously not; and it is just as impossible to represent the surface of the earth accurately on a flat surface. With a sharp knife cut down from the "poles" toward the center, or "equator," of the orange skin, taking care not to sever the hemisphere entirely. When a number of slits have been made, the skin may be laid approximately flat on the table, but while the "equator" remains just as it was at first, toward the "poles" there has been considerable spreading.

Now suppose there had been drawn on this orange skin, as on a little globe, a map—perhaps the map of North and South America. What would be the result as regarded the northern part of North America, the widest land area? The western point of Alaska and the eastern point of Labrador would be much farther apart than they were on the original orange skin, and there would be many "gaps" in the map. In making maps compromises are necessary in meeting this difficulty, and no flat map can ever represent accurately any very large part of the earth's surface. On an ordinary map of the world, for instance, where the degrees of longitude are shown as just as wide at the pole as at the equator, the land masses are all "top-heavy" toward the poles, appearing far wider there than they really are.

The subject of *projections,* or the devices resorted to with the object of lessening these errors, is too technical for such an article as



MERCATOR'S PROJECTION

this. Best known is *Mercator's projection,* which is useful for sailors' charts, but which by no means avoids the difficulties of map-distortion.

Map-Making in School. Such map-making as is referred to above—the free-hand sketching of continents, countries, states or provinces—is useful because it impresses upon a child's mind outlines and, if carefully done, comparative areas; and the value of such an exercise may be increased by the addition of rivers, mountains and cities. But this is by no means the most valuable sort of map-making for a child. He can obtain a far better idea of the principles of map-construction by charting his familiar environments. The earliest attempts should be simple—perhaps he may map out the schoolroom, with straight lines to represent the rows of desks, a square for the teacher's table, and a circle for the heater. But his map should be drawn to scale; that is, measurements should be made, and a scale of drawing decided upon. If the room is thirty feet by twenty feet, and the map is to be drawn upon a scale of five feet to one inch, the map will be six inches by four inches. Later the child may draw a map of the school yard or of his own yard, or perhaps even of the block in which he lives, but unless the idea of scale is kept in mind, no real gain is made. Of course such maps of limited areas do not give the pupil any idea of the difficulty of charting the "great round world," but they do show him many other things, such as the need for accuracy in measuring and the importance of scale.

Physical Geography. This second great division of geography, very commonly known as *physiography,* ignores every living thing, and treats of the earth's appearance and the changes which have been wrought and are being wrought to-day in its surface. The three "spheres" of the earth's surface which it considers are the land, the sea and the air, and it may be seen at once that these offer a basis for a very wide science. Were the continents always where they stand to-day? Is "as old as the hills" a just expression, or are there young hills? Why are some mountains smooth and rounded and some rough and craggy? Why are some rivers broad and sluggish and others narrow, dashing torrents? How deep is the sea? What makes the tides? Why does it hail in hot weather but never snow? What determines the direction of wind? All these and a thousand other questions, many of them so interesting that if a man has once put them to himself he cannot be content until they are answered, physical geography will explain. Though it does not deal with living things, it is a very "human" science, nevertheless, for it treats of the conditions under which living things exist. A more detailed discussion of the subject is given under the heading PHYSICAL GEOGRAPHY.

Biogeography. It is life, whether plant, animal or human, which is most interesting, and this last phase of geography is one of the broadest and most fascinating. To understand it thoroughly there must be a knowledge of mathematical and physical geography, for this "life geography" is mainly a study of the manner in which the form, motions, climate and the surface features of the earth affect living things.

Plant Geography. Anyone who has traveled to any extent has had his attention attracted

by the variations in the forms of plant life in different localities. In Canada there are vast forests of cone-bearers—pines, firs, spruces and hemlock; in the Eastern United States there are woods of beech and chestnut and oak; in Florida there are those gloomy, mysterious but beautiful swamps, the Everglades, while the western part of the continent has here and there great stretches where sage, cactus, yucca and similar plants grow. Sometimes one finds sharp contrasts. Thus, in the American continent, a high mountain range separates fierce deserts on the one side from fertile and productive lands on the other. In the tropical rain belt pour down the rains that make Central Africa an almost impenetrable jungle, flanked on both sides by inhospitable deserts. Now the geographer does not content himself with saying, "There are deserts where there is no water, and rich plant growths where rainfall is abundant;" he goes back of that and works out the causes which govern the scanty or the plentiful rainfall.

BEHAIM'S MAP OF THE WORLD

Prepared about the year 1490. The American continents were not known to exist, and it was believed the way was open straight across the trackless sea to the continent of Asia.

Nor is it climate only with which he concerns himself. It is not merely because of temperature and rainfall that the Canadian Northwest is a wonderful wheat-growing country; that Iowa produces great quantities of corn; that Florida grows grapefruit and that Italy is famous for its grapes. The soil plays a large part in determining all these crops, and the geographer must pay attention to soils as well. When it is considered that directly or indirectly, every form of animal life on the globe, including man, is dependent upon plants for its very life, the importance of such study of plant geography is evident (see PLANT).

Animal Geography. Animals are not so completely dependent upon conditions of temperature and moisture as are plants. If surroundings become too unpleasant and unfavorable, they can migrate, and, within reason, adapt themselves to a different environment. Nevertheless, there are distinct climatic zones of animal life as well as of plant life, and the animals of the Arctic regions differ as decidedly from those of the tropics as do the plants of the two sections. One may go to a zoölogical garden and see polar bears, lions, monkeys, Arctic foxes and elephants in adjoining cages, but they are not thus closely associated in their natural homes. Time was when many of the animal forms were far more widely distributed than they are at present, but changing climatic conditions led to repeated migrations and to the existing distributions. Here again, however, as with the plants, it is not climate alone which has been the determining influence. South America and Africa, for instance, are both equatorial continents, but they

are so widely separated that the animals of one continent apparently have never been able to migrate from the one to the other, at least in recent times. Nevertheless, there seems to be a very marked similarity between many species common to both. The monkeys, lizard species (alligators and crocodiles), antelopes and animals of the cat kind (leopards and jaguars) do not differ very materially. The ostrich of Africa is represented by the rhea in South America; and the species from which have descended the animals of the llama kind in South America are thought to be progenitors of the species from which the camel is descended. Such similarities are observed also in North America and Europe, which have many species both of animal life and plant life in common.

One of the most interesting phases of this animal geography is the subject of migrations, whether of birds or of animals. See BIRD, subtitle *Migration of Birds;* ANIMAL, subtitle *Migration of Animals.*

Human Geography. In a sense, all the other branches of geography may be considered as leading up to the study of man and his environment, which is so important and has so many divisions that it practically constitutes a science in itself. *Anthropogeography* it is called, but that apparently difficult word simply means the *geography of man.* There may be no hemlock trees in the desert, no lions at the North Pole, no sagebrush in the rich bottom lands of a river, but there are men almost everywhere, for man is the most adaptable of all living things. It may seem that a desert stretch is too dry to support life; that a swampy region is too unhealthful to be safe; that a mountain range is too steep ever to be accessible; but if once man's ambition is aroused he leads rivers to the arid land, drains the malarial swamp, and scales the lofty mountain to establish railroads or to sink his mines into its depths. He can face cold or heat, moisture or drought, but he does not thrive equally everywhere, and in consequence all parts of the earth are not evenly populated. The frigid zones furnish but a scanty living; the tropics take from man his ambitions and his desire to work and leave him lazy and content merely to exist; and it is therefore the temperate zones that people have most thickly settled. Man and the camel are the only animals that, unaided, can cross a desert. The one is educated or trained to overcome the conditions of his environment; that is, he "knows how;" the other is physiologically formed for desert life; he is "built that way."

Then there are the different races of men—the black, the red, the brown, the yellow and the white. Is there any special cause for the differences that exist among them? Is there any reason why they live as they do—why the Caucasian race did not originate in Africa and the negro in Europe? See RACES OF MEN.

The subject of occupations, too, is fascinating. Is the principal occupation of a people determined by their character, the geographer asks himself, or does it determine that character? He finds, on careful study, that the two react on each other. Living conditions largely determine occupation, and if a country evolves naturally, there is a regular sequence of activities. First, when settlers are few and land is plenty, herding is likely to be the common pursuit, for each man may have a large acreage on which his stock may graze. But as more people are attracted to the region, each man's holdings become smaller and farming takes the place of pastoral pursuits, for not nearly so much land is necessary for agriculture as for stock-raising. The time comes, however, when the people become so closely crowded together that the soil cannot support them all, and manufacturing and commerce partly take the place of agriculture. There are, however, other determining factors, particularly climate, topography and mineral content. Temperature and rainfall mark the boundaries of the cotton belt; the inclination of the earth's axis fixes the limits of the corn belt; glacial drift determines the loci of the best wheat lands; coal and water power control the area of manufactures; and harbors and easy trade routes very largely govern commerce.

Political Geography. Natural conditions, climate, soil, mountains, seas, do not determine all of geography, for a part of it is man-made. Is there any reason, so far as physical features affect them, why the United States and Canada should be separated just where they are? Would not a far more natural dividing line between two possible countries have been the Rocky Mountains, that great barrier which people hesitated to cross for long years after the eastern part of the continent was settled? The branch of geography which deals with the social activities of the human race, with human governments, with the size and boundaries of countries and with the location of cities, is called *political* geography. Very often geographic conditions show the closest con-

nection with political. It is natural, for instance, that Great Britain, separated from the mainland of Europe, should have developed as a distinct country, or that Italy or Spain, jutting peninsulas with high mountains between them and the continental mass, should have an equally distinct existence. But in Central Europe, the various states of Germany had in many cases purely arbitrary boundaries, and it is not strange that there should have been constant friction, each state trying to widen its borders at the expense of others.

Economic, or Commercial, Geography. This is, in a sense, a part of political geography, since it is man-made, but it has been given special study and is usually considered as a distinct branch. It treats of the industries of the world; of agriculture, and the reasons for its variations in different parts of the world; of raw materials and the principles which govern their manufacture into finished products; of mineral resources and why they are made the most of in some regions but neglected in others; of trade routes and transportation facilities, and the great part which commerce plays in the modern world.

The industrial and commercial phases have had a particularly close connection with political geography, in that they have determined so largely the location of cities. There was a time when the site for a city was chosen because it was easily defended, but to-day that question is seldom considered. The cities of Massachusetts are where they are chiefly because of the falls in the rivers, which furnish water power; London is the world's metropolis because it commands one of the most important trade-routes in the world; and Duluth owes its growth to the fact that the iron which is mined not far from it is easily shipped from there by way of the Great Lakes. Such instances might be multiplied indefinitely. J.R.

Interesting Ways of Studying Geography

"Home" Geography. There was a time, not so very many years ago, when a child beginning the study of geography took up one continent and then another, devoting about the same amount of time to each. He studied about the surface features, about the rivers, the people and the industries, spending comparatively little time on industrial subjects. More time was devoted to his own country, perhaps, than to any other, but his own state received no special attention and as for his home city or town and the activities that went on there, there was little or nothing said of them. In this day all that is changed. Teachers realize that in geography as in other subjects the pupil learns best if he proceeds from familiar things to those unknown, studying contrasts and similarities. Every little hill, every stream, every group of plants which the child sees on his way to school may be made to do its part in helping him to picture the mountains, the rivers, the forests or the prairies which he will find described in his textbooks. If he has ever watched the little sand flats deposited by a sluggishly flowing brook or ditch, he will have no difficulty in understanding the formation of the deltas of the largest river.

When one considers industrial phases, the value of home study is even more marked. If the town has some one dominant industry, it may be made clear to pupils why that instead of some other industry has grown up there. Perhaps it is a flour-manufacturing town, because the wheat fields are not far away; perhaps the irrigated land about the town grows excellent beets, and beet sugar factories are numerous; perhaps there are no manufactures but the trade is large because the region round about is productive, and a lake, a river or a great railroad makes transportation easy. It is far more worth while for a child to realize that geography has a determining influence on industries, and to understand in detail such industries as are available for study than for him to be able to recite glibly the "principal products" of a list of foreign cities.

Study by Comparison. Having become familiar with his own town and his own state or province—and in some localities an entire year is devoted to the study of just that much of geography—the student, whether he be a pupil in school or someone who has taken up the study outside of school, is ready to proceed to gain an idea of wider areas; and to a dweller in Canada or the United States the "wider area" represented by his own country is very wide indeed. Yet too few actually realize the vast size of their home country. They may be able to recite mechanically statistics as to its area and population, but these make little appeal to their imagination. There is the inhabitant of British Columbia, for in-

stance; does he know that his province, which is only one-tenth of the Dominion, would contain three times over the islands of the United Kingdom, that nucleus of the greatest empire in the world? Does the dweller in the so-called "Middle Western" section of the United States, in Illinois for example, realize that he is really an Easterner, since the geographical center of the country is in Kansas? Does it enter his mind that, possibly, his own state, with two others of almost equal size and fully equal resources, like Iowa and Ohio, could be placed in the state of California and that there would still be room to spare? The comparisons of this sort which can be worked out merely with the aid of a table of statistics are innumerable.

The articles in these volumes on the various states and provinces contain statistics as to area and population. With these as a basis, answer the following questions:

How does your state or province rank among the divisions of the country as to area?

How does it rank as to population?

How many states or provinces have a larger number of people to the square mile?

Has the largest state or province the greatest number of inhabitants?

If the population of the largest state or province were transferred to the smallest, what would be the density per square mile? If the population of the smallest were transferred to the largest?

Which state or province has the greatest railway mileage?

Which has the greatest in proportion to area? In proportion to population?

If the most sparsely populated state or province were as thickly settled as the most densely, how many inhabitants would it have?

If this process were reversed, what would be the population of the one which at present has the greatest density?

Is the density of population of your state or province greater or less than that of the country as a whole?

A Wider View. After gaining an idea of the home country it will be interesting to bring into the comparison other countries, and such a chart as the following will prove very helpful in reaching an understanding as to comparative areas, populations and other topics. Canada and the United States or one province and one state may be compared; it is possible to vary the combinations widely. In making your study, substitute your own province or state for the one here given:

DIVISION	AREA IN SQUARE MILES	POPULATION IN ROUND NUMBERS	POPULATION PER SQUARE MILE	RAILROAD MILEAGE
Canada	3,745,574	7,200,000	2	29,330
United States	3,000,000	92,000,000	31	244,000
Ontario	407,262	2,525,000	6	9,000
Illinois	57,000	6,000,000	105	12,200

Boundary Lines. Another interesting topic concerns the boundary lines of political divisions, whether countries or the minor divisions known as states and provinces. In very many cases, as stated above, these have been purely arbitrary, for this is the man-made phase of geography; but often physical conditions have had a strong determining influence, and it is interesting in the study of history to bear this subject in mind—to see whether countries shut in by natural barriers have had any less difficulty in holding their frontiers against enemies. Here, too, questions are perhaps more suggestive and illuminating than a discussion, but these are to be answered with the aid of maps and not of charts:

Are the continents political or physical divisions?

Which continent is most completely isolated? Which are the least isolated?

Are there any continents so closely connected that they might almost be classed as one land mass? Is the boundary between them to any extent arbitrary?

Are North America and Central America separated by natural or by arbitrary boundary lines? Central America and South America?

How many countries of Europe have arbitrary boundary lines?

Would it have been reasonable to have placed the boundary between France and Spain at the Ebro River? Why?

Is there any apparent physical reason why Belgium and the Netherlands could not have been one nation? Germany and Austria-Hungary?

Is there any more reason why Russia should own Siberia than England, for example?

What other country has had the same advantage as Great Britain in building up a strong empire, reasonably safe from invasion?

Turning to Canada and the United States, locate several natural boundary lines between Canadian provinces. Locate twenty between the states of the Union.

Can you find instances where natural boundary lines might have been used, but arbitrary ones were chosen instead? Do you know the reason why, in any of these cases, the natural boundaries were rejected?

If, in the days of exploration and settlement, one nation had colonized the eastern coast of North America, another the western, would it have been possible for two nations to develop

within the present borders of the United States? Where would the most natural boundary have been?

The "Human Interest" Side. Any student, whether man or boy, is naturally more interested in human beings than in things, and in recent years more and more recognition is being given to this fact. No longer is the seeker after geographic knowledge made to fill his brain with the "topographic features" of every country he studies until any interest he may actually have felt in that portion of the world has died. If there are rugged mountains, broad valleys, marshy coast land, he learns about them, it is true, but they are related in some way to the life of the people. The mountains, perhaps, though barren and inhospitable, contain stores of gold, and have thus played a large part in the history of the country by attracting many people; the broad valleys are the most thickly-settled parts of the country, it may be, while the swampy land supports its hordes of people, too, by furnishing just the right sort of land for rice-growing.

The people—their characteristics, their customs, their occupations, their needs—constitute the central factor in geography as it is studied to-day, and very interesting is the study of the connection between geography and people. The articles in these volumes on the various countries of the world lay especial emphasis on the people. So far as may be, if the inhabitants are enough alike to make possible any general statements, their physical and mental characteristics are sketched, and some attention is given to their modes of dressing and of living. In many instances, too, the articles are supplemented with pictures which tell more clearly than any description their story of the home life of the people. The way the women of Burma dress, the method of travel in China, the mode of life in an African village—these are but a few of the many stories the illustrations have to tell. J.R.

Study by Outlines. Another modern tendency which is too valuable to be a mere passing fad is toward the use of outlines. Too often children acquire information in the most illogical and jumbled manner; the ideas which they gain are correct, to be sure, but have no apparent relation to other ideas, equally correct, which are stored in other pigeon-holes of their brain. Study according to an outline does away with much of this danger, and makes the lessons not only more interesting but easier to remember. These volumes contain a great number of helpful outlines on geographic subjects. The articles CITY, PROVINCE and STATE have general outlines which may be applied to the study of any city, province or state, while each continent, each important country and a number of the great cities have detailed outlines fitted for specific study. Questions accompany most of these outlines.

Consult Redway's *Commercial Geography;* Gregg and Kirby's *The World by the Fireside;* Lyde's *Man and His Markets;* Carpenter's *How the World is Fed, How the World is Clothed, How the World is Housed* (three small volumes); Rocheleau's *Geography of Commerce and Industry.*

Related Subjects. In these volumes there are thousands of articles on geographical topics, and no attempt has been made to index them all here. They are all, however, readily accessible if the lists of related topics under many of the following articles be consulted. Under the article EUROPE, for example, are listed all the political divisions of the continent, such as *France,* and under each of these, in turn, are indexed the cities, rivers, mountains and other geographic features. Each *state* and *province* likewise has its own list of related topics.

MATHEMATICAL GEOGRAPHY

Aclinic Line
Antarctic Circle
Arctic Circle
Axis
Chart
Day
Degree
Equator
Globe
Hemisphere
International Date Line
Latitude
Longitude
Longitude and Time
Map
Meridian
Minute
Month
Pole
Seasons
Sidereal Time
Standard Time
Time
Tropics
Year
Zone

PHYSICAL GEOGRAPHY

Air
Alluvium
Atoll
Avalanche
Basin
Blizzard
Bore
Calms, Regions of
Canyon
Cave
Chaparral
Chinook
Climate
Cloud
Coastal Plain
Cyclone
Delta
Desert
Dew
Divide
Doldrums
Dust, Atmospheric
Dune
Earth
Earth Currents
Earthquake
Equinox
Erosion
Ether
Fall Line
Fiord
Flood
Flood Plain
Fog
Frost
Geyser
Glacier
Gulf Stream
Hail
Harvest Moon
Haze
Hill
Horizon
Horse Latitudes
Humidity
Hurricane
Hydrography
Icebergs

Island
Isobars
Isothermal Lines
Isthmus
Japan Current
Khamsin
Labrador Current
Lagoon
Lake
Land and Sea Breezes
Lava
Levant
Lightning
Maelstrom
Marsh
Mesa
Meteorology
Mirage
Monsoon
Mountain
Natural Bridge
Norther
Oasis
Ocean
Ocean Currents
Oceanography
Physical Geography
Plain
Plateau
Prairie
Prevailing Westerlies
Quicksand
Rain
Rainbow
River
Saint Elmo's Fire
Savanna
Simoom
Sirocco
Sky
Snow
Snow-Line
Spring
Stalactite and Stalagmite
Storms
Talus
Terrace
Thermal Springs
Tides
Tornado
Trade Winds
Tundra
Twilight
Typhoon
Valley
Volcano
Waterfall
Watershed
Waterspout
Waves
Whirlpool
Whirlwind
Wind

ISLANDS

See list, in article *Island.*

LAKES

See list, in article *Lake.*

MOUNTAINS

See list, in article *Mountain.*

OCEANS

See list, in article *Ocean.*

RIVERS

See list, in article *River.*

SEAS, GULFS AND BAYS

Adriatic Sea
Aegean Sea
Arabian Sea
Azov, Sea of
Baffin Land and Baffin Bay
Baltic Sea
Bengal, Bay of
Bering Sea
Biscay
Black Sea
Bothnia, Gulf of
California, Gulf of
Caribbean Sea
Caspian Sea
Cattegat
Chesapeake Bay
China Sea
Darien
Dead Sea
Delagoa Bay
[illegible]ware Bay
[illegible]h Channel
[illegible]
Georgian Bay
Guinea, Gulf of
Hudson Bay
Indian Ocean
Ionian Sea
Irish Sea
James Bay
Long Island Sound
Marmora, Sea of
Mediterranean Sea
Mexico, Gulf of
Minas Bay
Narragansett Bay
North Sea
Okhotsk, Sea of
Persian Gulf
Puget Sound
Red Sea
Riga, Gulf of
Saint Lawrence, Gulf of
Skagerrak
Solway Firth
Finland
Florida, Gulf of
Fundy, Bay of
White Sea
Yellow Sea
Zuider Zee

MISCELLANEOUS

Africa
America
Antarctic Lands and Seas
Arctic Lands and Seas
Asia
Australia
Central America
City
Europe
North America
Province
South America
State

GEOLOGICAL SURVEYS, *je o loj'i kal sur vaze'*, though maintained by the governments of the United States and Canada at an annual expense of hundreds of thousands of dollars, are said to be worth many times as much to the two countries. Organized primarily to aid geologists in their study of the past and present structure of the land, they also assist in the development of mineral resources by furnishing to the public reliable information about the location of various deposits. The topographical divisions prepare accurate maps of the country which are the basis of all commercial maps, and are so full of detail that they save much of the preliminary survey work usually necessary for railroads, canals, aqueducts, dams and reservoirs. In the United States the Survey has the additional duty of investigating favorable regions for irrigation systems and choosing the location for dams and reservoirs in connection with them.

The United States Survey is preparing a huge map of the whole country which will display the contour of each section, and show the villages and cities, roads, railroads and other artificial features in great detail. The map is published in sheets, each sheet representing an area contained within one degree of latitude and one of longitude. The scale varies from 1:25000 (which is about one inch to four miles) for desert regions to 1:62500 for districts thickly settled. A similar undertaking in Canada was commenced only a few years ago, and a few maps have been published, mostly of British Columbia areas.

The geological survey of Canada is older than that of the United States, having been established in 1842. Its most famous director was Dr. George M. Dawson, whose biography appears elsewhere in this work, and for whom Dawson City, in the Klondike gold region, was named. The United States Survey was formed in 1879 as a consolidation of several independent surveys which had been operating in the West. Its organization was largely due to John W. Powell, the explorer of the Grand Canyon of the Colorado River.

GEOLOGY, *je ol'o ji*, the story of the earth from its beginning through the millions of years or ages that no man can number, down to the present time.

The Story of a Shell. One spring day Tom brought his teacher a piece of rock in which there was a shell almost exactly like shells that he had found on the seashore when he was in Florida. The shell had turned to stone but its form had not been changed; even the smallest markings on it could be distinctly seen. Tom lived in a state far from the sea; moreover, he had broken this fragment of rock from a ledge on a high hill, and he said that the ledge was full of these shells. The first question he naturally asked was, "How did these shells get where I found them?"

Since all the pupils were interested in the question, the teacher told them he would help them to answer it, by showing them how to read the oldest, the largest and most peculiar book that man knows anything about, the book of the earth.

The Old Book. We usually think of the Bible as the oldest book, and so it is if we consider only books with paper leaves on which words have been printed; but the book which this wise teacher taught his pupils to read so they could answer Tom's question was made long before there were any men to read it. It is *The Earth,* truly a huge and heavy volume. The rocks are its leaves, and the fossils of the past ages, together with the plants and animals of the present time, are its letters and figures. The leaves are sometimes misplaced and now and then we find that one has been torn out, so in some places the record is not complete. But it is a wonderful story.

This book contains the history of the earth from its beginning to the present time. It tells us something about how the earth was formed, of the different changes it has undergone, the different kinds of rocks in its crust and of the many strange plants and animals that lived in the long, long ago. The story this book tells the scientists call *Geology,* for *Gea* was the old mythological name for the earth, but Tom's teacher called it *The Story of the Earth;* both mean the same thing to us. We shall read this story more easily if we begin at the present time; from observing the forces now at work changing the surface of the earth we can gain an understanding of how these same forces worked in the past ages.

The Three Spheres

Earth, Air and Water. The ancients believed that there were four substances from which all things were created; these were earth, air, fire and water. We have long since learned that fire is not a substance, but we know that the other three form the earth. The geologists consider these three substances as three spheres—the atmosphere (air sphere), the hydrosphere (water sphere), and the lithosphere (rock sphere).

The Atmosphere. We live at the bottom of a great ocean of air which extends upward to an unknown height—possibly 200 miles. At sea level it presses down upon us with the force of almost fifteen pounds to the square inch, and were this pressure materially changed we should become very uncomfortable. The pressure decreases as one rises to heights above sea level; the density is so much less even four miles upward that few people can survive an ascent of that distance. The air is composed of numerous substances mixed together; the most important of these are oxygen, nitrogen, carbonic acid gas and water vapor (see AIR). The atmosphere is and always has been an important agent in changing the surface of the solid parts of the earth. It does this chiefly through weathering, winds and rainfall.

Weathering. The atmosphere covers the earth like a mantle. By absorbing the heat of the sun's rays and reducing their intensity it shields the land and water from the intense heat which would otherwise fall upon them. It also prevents the absorbed heat from escaping into space when the sun is not shining. Thus the atmosphere is the great equalizer of

temperature, and were it not for its influence the burning heat of the day would be followed by intense cold at night. Nevertheless, there is sufficient change in temperature to cause freezing and thawing over large portions of the earth, and these changes in temperature cause the surface of the rock to break into fine particles, or, as the scientists put it, to *disintegrate*.

Again, some of the gases in the atmosphere combine with the rocks and form new compounds which, because they are not as hard as the original rock, soon crumble. The fine particles of rock and soil found on and around large rocks and at the foot of cliffs are formed chiefly by this quiet work of the atmosphere, which is known as *weathering*.

Wind. The atmosphere is constantly in motion, and currents of air, like currents of water, carry along more or less solid matter. An ordinary wind will move fine sand and a strong wind will move gravel; consequently, over some portions of the earth winds are constantly changing its surface. These changes are most striking in sandy regions, like Dune Park, Indiana, on Lake Michigan, where the sand is drifted like snow, and in desert lands, where the surface is very dry. In other regions the constant hurling of these particles of sand and dust against the rocks gradually wears them away and carves them into fantastic forms, as in Monument Park, Colorado. Moreover, however clear the air may appear to us, it always contains dust, and this dust is so fine that even the slightest current moves it. The particles of dust are so small and this movement is so gentle that we do not perceive them, but geologists estimate that this movement going on through all the ages since the earth was formed has caused marked changes on its surface.

Rainfall. The amount of water vapor in the atmosphere depends upon the temperature. The warmer the air becomes the more water it can contain. When the temperature is lowered sufficiently, the air becomes *saturated* with moisture, and as no more can be held some of the vapor falls in the form of rain or snow (see RAIN; SNOW). Some of the rain soaks into the ground and some runs down the slopes into the streams, carrying more or less soil with it. This soil is carried to the lower levels of the streams and there deposited as *silt*. Thus rainfall is an important agency in wearing down the higher and building up the lower levels.

The Hydrosphere. The hydrosphere, or water sphere, includes the water in the ocean and on the land. These different bodies of water are described in these volumes under their titles, as LAKE; RIVER; SPRING; OCEAN. Our purpose here is to show how they are causing changes on the earth's surface.

The Ocean. The ocean covers about three-fourths of the earth's surface, but owing to the position of the continents it is irregularly distributed and is gathered in a series of great basins. We are here especially interested in the action of the ocean in changing the surface of the land; for other particulars, see OCEAN.

Waves raised by wind and tides wear away the rock in many places, and deposit the sediment on the beach and on the bed of the ocean. In many places waves strike the coast with great force and they often wear caves in the rocks, or cut them into curious forms. They are one of the most powerful agents in wearing away the coasts of the continents.

While ocean currents move so gently that they do not affect the form of the coast line, they exert a great influence on climate, including rainfall, and in this way indirectly cause changes on the land. The ocean contains many plants and animals. When these die they settle to the bottom, and in this way the bed of the ocean is being constantly though very slowly raised. However, this change is so slight that in considering the story of the earth we need give no heed to its present influence.

Water. The effect of running water is described in the article EROSION. Lakes on a small scale cause the same changes that the ocean does on a large scale. Mineral springs often form solid deposits which are of interest because they show how some rocks have been formed in the past. These formations are so small that they are scarcely worthy of consideration when studying the changes on the earth's surface as a whole. Ice and snow are ever wearing down the mountains and filling up the valleys. See GLACIER.

There is another way also in which water is working changes and which we seldom consider because it is out of sight. Whence comes the water that bubbles up in springs, fills our wells and feeds the thirsty plants? It comes from the ground, and is generally known as *ground water*. The quantity of ground water in a given locality is largely dependent on the rainfall. The height to which it rises, that is,

the distance below the surface at which it may be found, is the *water table*. In a dry season the water table is lowered, while in a wet season it is raised. Ground water holds various sorts of plant food and other substances in solution. It is the chief source of nourishment for plants, and it also aids in the decomposition of rocks. It is, therefore, one of the agents whose work we need to remember when considering the changes now taking place on the earth.

The Lithosphere. The lithosphere, or rock sphere, includes the solid portion of the earth; this is about eight-ninths its *mass*, by which term, however, we do not mean its *thickness*. Geologists usually speak of it as the earth's *crust*. As the story progresses we shall find that geology is closely related to other sciences, especially astronomy, botany, zoölogy, chemistry and physics. Its subject-matter overlaps that of physiography at many points, and here the article PHYSIOGRAPHY should be referred to.

Reading the Rocks

Specimens. Tom's question about the shell and the teacher's method of answering it awakened a lively interest in rocks, and the teacher's desk was soon covered with specimens brought in by the pupils. Nearly all these specimens were gathered in the locality, yet some showed marked differences in color and structure. Some contained shells like Tom's; others contained shells of a different kind; in others were found objects that looked like twigs turned to stone. Still others revealed beautiful crystals and some had a glassy appearance. A similar collection can be obtained in almost any locality.

Classification. After the boys and girls had examined the specimens for themselves the teacher began his lessons. He asked the pupils to arrange them first into two groups, the hard and the soft rocks, and then to subdivide the hard rocks into those built up of rounded water- or wind-worn grains, those composed of crystalline grains, which show no wear, and a third class, those having a glassy appearance. The rounded grains of the first class, he pointed out, may be compared with the rounded grains of sand in rivers and seas and on deserts. From this comparison the pupils were led to conclude that originally these hard rocks were loose sands which later became consolidated. They are therefore called *sandstones*. The teacher went on to say that whenever they are so thoroughly consolidated as to split through the grains rather than around them, they are called *quartzites*.

All the glassy rocks, the pupils learned, were formed from a molten state only, and the hard non-fragmental granular rocks were once molten also. The grains of these interlock, and some have a crystal outline. These characteristics of grain develop only when rocks solidify from a molten or dissolved condition. Because great heat is necessary to make rocks molten they are called *igneous* rocks. *Igneous* comes from a Latin word meaning *fire*. Such rocks may be briefly defined as *hardened lavas*. See IGNEOUS ROCKS.

The pupils were then directed to test the soft rocks with muriatic acid. Those which gave off a gas they learned were *limestones*, the gas given off being carbon dioxide. The soft rocks which did not give off gas under the application of muriatic acid broke along parallel surfaces. The pupils noticed that these were fine grained, and that some were black and others gray and brown. Such rocks are called shales or slates, the slates being more compact than shales. The teacher told the pupils that shales and slates result from the consolidation of muds.

Next the pupils were told to look for fossils. These, the teacher explained, are relics of the plants and animals of a former era, which have been buried by natural causes in certain kinds of rock. They are to be found in the sandstones, quartzites, limestones and shales or slates, but not in igneous rocks. By a careful study of the specimens containing the fossils, and with the help of the teacher, the pupils arrived at the conclusion that these rocks must have formed from sediment that settled on the bottom of some body of water, slowly burying the plants and animals whose fossils the pupils had just discovered, and at the time these objects were buried the rock must have been soft mud. In time this mud dried and hardened into rock. Since these rocks were formed from sediment they are called *sedimentary* rocks, and since such rocks are usually formed in layers they are also called *stratified* rocks.

Each of the specimens was examined with a magnifying glass and its color and peculiarities were noted. In this way the principal minerals which form the rocks were learned.

They are quartz, feldspar, mica, hornblende, augite, clay, carbonate of lime and talc. (Most of these are described in these volumes. See also MINERALS AND MINERALOGY.)

What the Rocks Tell. As the next step in their lesson, Tom and his classmates learned in what way the rocks bedded in the earth throw light upon its history. Could the surface layer of *mantle* rock be removed from the land, that is, the upper layer of soil, clay, sand, gravel and broken rock, there would be exposed a zone of solid rock, possibly many miles thick. About four-fifths of this consists of rock arranged in layers, that is, stratified rock; the other fifth is crystalline. The crystalline rocks are of two types, igneous and *metamorphic*. This latter term is applied to rocks which exhibit marked changes from their original condition. Therefore metamorphic rocks may have been either stratified or igneous in their first state.

An examination of the successive layers of stratified rock shows that sometimes the different beds of rock have been deposited in regular order, one on top of another, without any alteration in the position of the surface on which they were deposited, and in other cases the underlying layers have an angle of inclination different from that of the overlying beds. But whatever their position, we know that the overlying beds must have been deposited at a later period than the deeper ones, and so through these various layers we read backward to learn about the earth. The fossils in the sedimentary rocks indicate something of the kinds of plants and animals that lived when the rocks in which they are found were formed, and the pupils were intensely interested when their teacher told them that the youngest beds of rock prove that the life which existed when they were deposited bore marked resemblances to life of the present time.

Fossils in deeper rocks show more and more variations from life of to-day, and when the lowest that contain distinct evidences of life are reached, the evidences point to types far removed from those that we now know. The pupils were curious to learn if rocks had been found giving no evidences whatever of life on the earth when they were deposited. Their teacher told them that so far as geologists could learn, life may have existed when the most ancient rocks were deposited, for rock formations apparently without any fossils contain graphite beds or carbon-bearing slates and limestones. Carbon is a characteristic element of both plant and animal organisms and graphite is nearly all pure carbon. Furthermore, lime carbonate, of which limestones are composed, is formed through the agency of plants and animals.

The order of the formation of igneous rocks to a certain extent is revealed by the relation they bear to the stratified. In some cases the latter are broken through by lavas, showing that the stratified rocks were the earlier formed. In the majority of cases the metamorphic rocks lie beneath the sedimentary layers and are often broken through by igneous rocks. In the lowest rock series there is much igneous rock, and geologists generally agree that there was an early period of dominantly igneous activity. It is probable that this remote igneous era involved rather widespread volcanic conditions similar to those which occur locally at the present time. Throughout all geologic history sedimentary and igneous rocks have developed contemporaneously.

The story told by the rocks is not an unbroken record by any means, for no one has ever been able to proceed directly downward through the entire series of bedded rocks. Geologists have made their investigations from edges of various rock layers in places where by warpings or tiltings they have been brought to the surface, or where they have been exposed by the wearing away of overlying beds. Here and there, in one land and then another, throughout the world, the story has been read, and the records have been pieced together as completely as is possible with the data available. To the average person the amount of information gathered seems incredible. E.S.

The Story of the Earth

Its Origin. Tom and his classmates were now ready to follow their teacher far afield to learn the story of the earth. Question after [illegible]estion came to their minds. How was the [illegible]h formed? How did it reach its present [illegible]tion? How long did it take for these changes to occur? Could such questions be answered? If so, how? These and many similar questions the geologists have attempted to answer, and some of their conclusions rest on a reasonable basis of fact. Others they have to admit are unanswerable.

Not one of the pupils had forgotten the story of the origin of the earth as it is given in the Bible: "In the beginning God created the heaven and the earth. And the earth was without form and void." Since these words were written, their teacher told them, a number of theories have been advanced by astronomers and geologists to explain the beginnings of the earth from a scientific point of view. Practically all, however, start with the idea that the earth and other planets of the solar system were evolved from a nebula of some kind. The theory known as the *nebular hypothesis* (which see) for a long time had wide acceptance. According to this theory the parent nebula was a body of hot gaseous matter that tended to take the form of a globular rotating mass. As this mass gradually cooled it contracted and threw off rings of rotating matter, each of which formed a planetary system.

A more recent theory, the *planetesimal hypothesis,* is now finding general favor with scientists who have rejected the nebular hypothesis because of certain grave defects. According to the newer theory the original nebula consisted of swarms of small bodies called planetesimals, which moved in orbits about a common center. As these small bodies pursued their slightly different orbits they came together and were welded by heat and pressure into those bodies we call the planets, planetoids and satellites. This process went on for ages, and the earth grew by capturing other planetesimals. The great central mass of nebula formed the nucleus of the sun. But the pupils wished to know how they could fill in the details. Were the mountains always here? Where did the water that fills the ocean basins originate? What is it like in the interior of the earth? This is what they learned.

The Interior. Geologists *infer* that the interior of the earth is hot because (1) hot vapors and molten lava from beneath the earth's crust are given out by volcanoes; (2) hot springs, in some of which the water is at the boiling point, are found in various parts of the globe; (3) as men proceed downward into mines and deep borings they find that the temperature increases at the rate of about 1° F. for every fifty or sixty feet of descent. It must be remembered in all discussions of the earth's interior that man has as yet merely scratched the surface. The deepest mines extend downward only a little over a mile, and it is almost 4,000 miles to the earth's center.

Therefore the condition of the interior, that is, whether it be molten or solid, is also a matter of inference. Some authorities have believed the nucleus of the globe to be in a molten state; others think that except in certain local spaces, the earth is rigid and solid from surface to center. The first theory, that the interior is in a molten condition, is no longer generally accepted because the earth, in its relations to other members of the solar system, acts like a solid rigid body. Also, the average density of the earth is much greater than that of the rocks at the surface, pointing to an interior that is very dense and heavy. It seems probable to most geologists that the interior is solid, and so hot that under ordinary conditions it would melt. Melting is prevented, however, by the great load of the earth's crust, the melting point of rocks being raised by increase in pressure. It is held by many that the rock of the interior is molten only in those places where the pressure is relieved; that is, where the crust is upreared under mountain folds.

Air and Water. The origin of those two spheres of the earth that we call the atmosphere and the hydrosphere cannot positively be stated. Some of the theories once held are regarded now as of no more value scientifically than so many fairy tales. According to the nebular hypothesis the primitive atmosphere was of vast extent, heavy and very hot, and it contained all the water of the globe, as well as that portion of the carbon dioxide and oxygen now found in the atmosphere and in organic tissues. Also, these constituents were abstracted by the cooling earth from the atmosphere, which thereby suffered gradual depletion. It is not necessary here to go into details as to why this theory is weak; it is sufficient to say that a critical examination of the biologic and physical aspects of the earth shows that it rests on no foundation of fact.

A more plausible theory has been worked out by the geologists who hold to the planetesimal hypothesis. In brief, it is as follows: In the early stages of the earth's history it held a very thin atmosphere which grew as the earth grew, by capturing planetesimals from the central nebulous mass. When volcanoes came into action they added to the atmosphere by contributing to it, as they do to-day, water, carbon dioxide and other gases. As soon as the atmosphere became saturated with water vapor the latter was condensed into water, forming the beginning of the hydro-

sphere, and when water began to accumulate on the surface of the earth it gathered in depressions which ultimately became the ocean basins.

Great Earth Movements. Mountains, plateaus and continents have been formed by certain great periodic movements which began in the early stages of geologic history. Nearly all of the mountains are due to the *folding,* or wrinkling, of the earth's crust, and in a large number of cases the folded mountains are near the borders of continents, as the Coast Ranges of North America. Folded mountains, however, sometimes occur in the interior of continents, as the Urals and the Alps, and the mountains of Central Asia. (The eruption of igneous rocks is responsible for the formation of mountains of the volcanic type, such as Vesuvius and Rainier.) Plateaus are made up of great blocks of strata that have been elevated by earth movements of even greater magnitude than those which formed the mountains. The forces that caused the folded mountains took the form of horizontal thrusts; plateaus seem to have been raised by vertical forces. At the surface, the blocks that make up the plateaus are separated by fault-planes (see FAULT).

The continent-forming movements differ from the plateau-forming movements chiefly in magnitude, the former being much the more massive. Plateaus are simply parts of a continental mass that have suffered additional movement, and they bear about the same relation to a continent that one fault block of a plateau does to the plateau as a whole. It is supposed that plateau- and mountain-forming movements began with what geologists call the *master* movements—the sinking of part or all of the ocean bottoms. Simultaneously with the settling of the ocean basins occurred the *squeezing up* of the continents. Both the continents and the ocean basins are believed to have been formed very early in the history of the earth, and both have been subjected to various changes since then. The basins have suffered further sinking and the land masses further elevation; the tendency, too, has been for the basins to be extended and the continents to be restricted. These movements in turn have been offset by the building up of coastal plains along the borders of continents (see COASTAL PLAIN), and by the depositing of sediment on the ocean floor. It must be remembered that all of these changes are proceeding at an exceedingly slow rate. E.S.

Divisions of Time

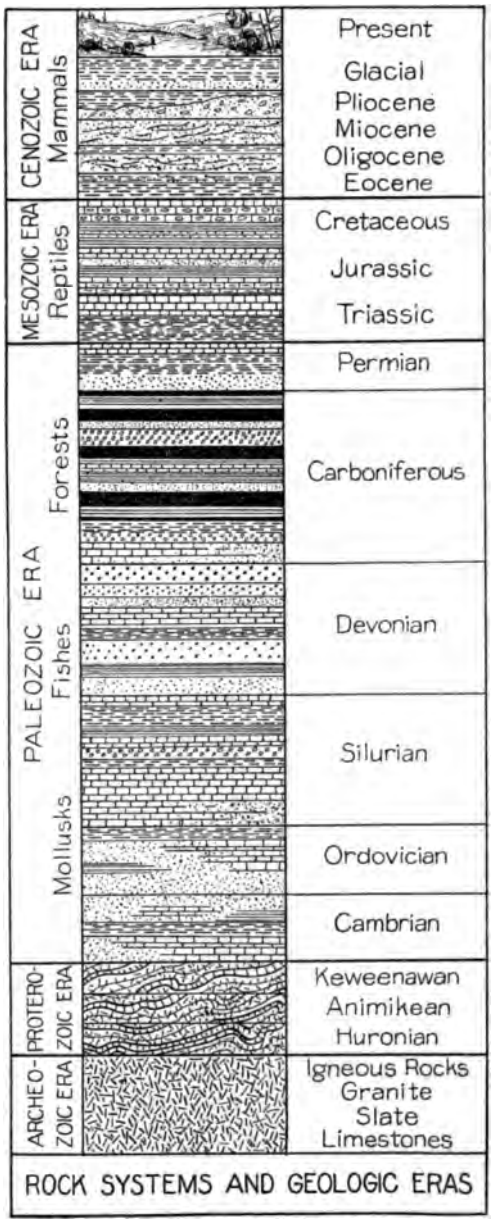
Principles of Division. Just as we divide present time into centuries, years and months, so do geologists divide the ages of the earth into longer and shorter periods. They are not all agreed upon some of these divisions, and there is a slight difference in the systems employed in Europe and in America. The divisions are founded upon some leading characteristic which indicates a great change from the conditions of a preceding time. No attempt is made to measure the length of these divisions in years, but the relative length of each period is estimated by the number and thickness of the rock systems it includes. A division including rocks of great thickness is considered to be longer than one whose formations are not so thick. All geologists consider the earth to have been in existence millions of years.

Eras and Periods. The large divisions of time are called *eras,* and each era is divided into *periods.* The names of these divisions indicate some prominent characteristics, or their order of occurrence. The *Archeozoic* Era is the era of *ancient life;* the *Proterozoic* Era, that of *earlier life. Paleozoic,* the name of the third era, means *old life. Mesozoic,* the name of the fourth era, means *middle life,* and *Cenozoic,* the name of the last, means *recent life.* In the publications of the United States Geologic Survey, the term *Algonkian* is used as a synonym for *Proterozoic.* The table on page 2439 includes the divisions of geologic time generally accepted by American geologists. It should be read from the bottom upward.

Eras Described. The rock formations of the Archeozoic Era are known as *Archean.* This system extends downwards to unknown depths and is composed largely of rocks of metamorphosed igneous origin, though there are some metamorphosed sediments. Its upper limit is generally assumed by geologists to be the base of the oldest system which is dominantly sedimentary. The Archean system contains some iron ore and ores of other metals, particularly gold, but these are deposited in comparatively limited amounts. No fossils of any kind have been found in the Archean series; thus there is no clue to the character of the life that then existed. The presence of life during this

era is inferred because of deposits of carbonaceous material and of limestones.

During the Proterozoic Era sedimentation for the first time became the principal process in the formation of rock. There is, however, considerable igneous rock with the sedimentary formations. To this era belong the formation of the iron ores of the famous Mesaba Range, in Minnesota, and of other Lake Superior regions in Wisconsin and Michigan. These ores were formed for the most part in the Animikean Period (see table). A few fossils have been found in Proterozoic rocks, but these are very rare. However, they make the existence of life in this era a matter of certainty. Other evidences are the presence of carboniferous shales and slates and of limestone.



The Cambrian, the first period of the Paleozoic Era, is of special interest and importance because its rocks constitute the oldest system known that contains an abundance of fossils. It is therefore the first satisfactory record of life. This system contains all the common aspects of sedimentary rocks—conglomerates, sandstones, shales and limestones—but in most regions the sediments have been cemented into solid rock. In some cases the sandstones have been changed into quartz schists, the shales into slates and the limestones into marble. Most of the fossils represent the shells or tracks of marine animals buried in sands and muds, but the absence of fossils of land species does not prove that no life then existed outside of the sea. Every great division of the animal kingdom except the vertebrate (backboned) animals was represented, but even though no vertebrate fossils have been found in the Cambrian series, geologists are not prepared to say that there were no vertebrate animals in that period.

Among the invertebrates known to have existed are several kinds of mollusks, sea worms, sponges, a few forms of the protozoa group (see PROTOZOA) and corals. Traces of soft jelly fish have been preserved. The highest in organization of the Cambrian animals was the trilobite, now extinct. It was related to the modern crab and crayfish and belonged to the arthropoda group (see ARTHROPODA). It is supposed that with the abundance of animal life there was a corresponding abundance of vegetable life, to furnish the needed food supply. Geologists also infer from the shells, plates and other forms of protective covering characteristic of so many animals of the Cambrian Period that other species existed of which the fossils bear no record, and against which the known animals had to defend themselves.

It is not possible here to take up in detail each of the succeeding periods, but certain striking developments may be pointed out. The fossils of the next period, the Ordovician, are almost entirely those of marine invertebrates, but among them are the first-known remains of fishes. The dominant group of animals is the Cephalopoda (which see), the

highest class of mollusks. Some of these grew to immense size, bearing shells twelve or fifteen feet long and a foot in diameter. On the land there were flying insects, implying the existence of vegetation and of an atmosphere that would be adapted to air-breathing creatures. The actual record of land plants, however, is meager and unsatisfactory.

The Silurian Period is marked by the formation of coral reefs, the first appearance of scorpions, and a rich and varied development of echinoderms (which see). Fossils of land life continue to be meager, and likewise little is known of plant life of the sea. Following this period is the Devonian, some of the rock formations of which are of importance commercially. The Upper Devonian, for example, is the chief source of oil and gas in the western section of Pennsylvania and one of the sources in West Virginia; the Middle Devonian in Ontario produces oil; and the Old Red Sandstone of Great Britain and Ireland is of the same period. In certain sections of Germany large quantities of iron, tin and copper have been taken from the Devonian series.

During this period (and thereafter) marine fishes were abundant, and there were sharks having fin-spines a foot in length. Barnacles of the modern *sessile* type, that is, attached directly by the base to other objects, made their first appearance, and there appeared and declined in this division of time a strange animal called *ostracoderm*, which formed a link between arthropods and vertebrates. It was related to the fishes, but entirely lacking in vertebrae. Plants, snails, insects, myriapods (thousand-legged worms), scorpions and amphibians (which see) are known to have lived on the land, and the Devonian Period saw the origin of ferns and of the gigantic progenitors of horsetail rushes and club mosses (see HORSETAIL RUSH). Fernlike plants predominated.

The Carboniferous Period, divided into Lower and Upper Carboniferous, is an especially important epoch in geologic history from an economic standpoint. To the second division may be referred the rich coal measures of Pennsylvania (anthracite and bituminous), coal sections in Michigan, Illinois, and the states from Iowa to Texas, and the coal deposits of Nova Scotia and New Brunswick (see COAL). Iron ores of the system occur in Pennsylvania and Eastern Ohio, and oil and [illegible] in Oklahoma, Kansas and Illinois. In [illegible]orkable coal of the Upper Carboniferous is found in Great Britain, Ireland, Belgium, France, Spain, Germany, Austria and Russia, and the system is coal-producing elsewhere, as in China and Brazil.

From the Lower Carboniferous stage comes the earliest wood which shows rings, but the record of land life is as a whole inadequate. Sharks were supreme in the open seas and were more abundant than in any later period. On the other hand the record of land life of the Upper Carboniferous stage is unusually full. Gymnosperms (plants whose seeds are not enclosed in a seed-case) were present in great abundance. Giant ancestors of the modern horsetails grew in the forests to a height of sixty to ninety feet, and there were abundant growths of huge club mosses and fernlike plants. Since coal is of vegetable origin, the coal measures bear wonderful records of the complex plant life of the Upper Carboniferous age.

Animal life in this stage of the world's history is also abundant. On the land lived amphibians, insects (including cockroaches, locusts, crickets and bugs, but no moths, butterflies or flies), spiders, scorpions, myriapods and land snails. It is in the later coal measures that fossils of amphibians (the first land vertebrates) are first found in abundance and variety. Another important feature of the age was the development of fresh-water fishes, mollusks and crustaceans.

In the final period of the Paleozoic Era, the Permian Period, there were gigantic geographic changes, through which great areas of sea bottom were converted into land. As a result, both plant and animal life became greatly impoverished. Of the new plant types which appeared one is thought to be the ancestor of the group which includes the giant sequoia (which see). Before the end of the period the amphibians were overshadowed in numbers by the reptiles, their probable descendants. Though the differentiation between the two groups began earlier, the reptiles did not appear as a large and complex division until well into the Permian Period. Marine life was greatly depleted, but the fresh waters teemed with fishes of a somewhat modern character. Geologists have found that the Permian age presents numerous problems that are difficult of solution. This is due to widespread glaciation in India, Africa and Australia, near and within the tropics.

The Triassic Period, which ushered in the Mesozoic Era, was characterized by an extraordinary development of the reptilian class,

including crocodiles, flying saurians, lizards and other scaled reptiles. Before the period closed certain reptiles had made their home in the sea. There also appeared the race of dinosaurs (see DINOSAURIA), ungainly monsters that attained full development later in the era. In the Triassic series are fossils of a primitive form of mammals.

The Jurassic Period was characterized by an extension of the seas, as a result of which marine life again assumed a leading place in the geologic record. Among the fishes were the forerunners of the modern garpikes and sturgeons, and various sea reptiles made their appearance. Land life is especially interesting in that it exhibits slow progress towards types that exist to-day. The leading plants were cycads, conifers, ferns and horsetails. Among the animals were flesh- and herb-eating dinosaurs, some of the latter reaching a length of sixty feet. The herbivorous dinosaurs, which are first known in the Jurassic system, were horrible-appearing monsters, but unwieldy and stupid. In this period flying reptiles reached full development. Though small at this time, they later attained a wingspread of nearly twenty feet.

Of especial importance is the differentiation in this period of the oldest-known bird, a descendant of the reptiles. It had reptilelike claws, but its front limbs were adapted for flying and it was clothed with feathers. Traces of its reptilian ancestry may be seen in its long vertebrated tail and its toothed jaws. Up to this time the fossil record of mammals is very meager.

The Mesozoic Era closes with the Cretaceous Period, divided into Lower and Upper Cretaceous. By some geologists the Lower Cretaceous is known as the Comanchean and the two are considered as distinct periods. The earlier of these is characterized by one of the most striking evolutions in the history of plants—the appearance and widespread development of angiosperms (which see), plants whose seeds are enclosed in a seed-case. (It is possible that they had their origin in the late Jurassic Period.) With the development of flowering plants there was probably a corresponding development of insect life.

The later Cretaceous age is preëminently the coal period of the western part of the North American continent; and the close of the period was marked by extraordinary volcanic activity. Plant life on land began to assume a modern aspect, and among the present-day genera which appeared were those which include the birch, beech, oak, walnut, sycamore, tulip-tree and maple. Grasses had their origin in this age, and palms grew abundantly. The most important plants that support animal life had now made their appearance, laying the foundation for the future marvelous evolution of the higher animals. Reptiles, especially dinosaurs, continued their dominance among land animals; birds existed both on land and sea, but the marine birds were the more important. Turtles appeared for the first time in the ocean, and some of these were of enormous size.

The final era, the Cenozoic, brings us up to the earth as we know it to-day. The transition of life from the Mesozoic to the Cenozoic was characterized by four significant features: the appearance of new marine species; the practical disappearance of the great saurians and decided changes in other reptiles; the predominance of mammals, and the continuance of large numbers of Mesozoic land plants. Through the different periods of the Cenozoic there was steady progress toward life as it now exists. Before the close of the Eocene Period nearly all existing groups of mammals had become well defined. Primitive types of the horse, pig, hippopotamus, camel, dog and opossum appeared, and some mammals, like the land reptiles of the preceding era, took to the sea. Thus originated whales, dolphins, porpoises, manatees, dugongs, seals and sea lions. Nearly all types of marine invertebrates had assumed their modern forms.

The evolution of the higher animals through succeeding periods need not be discussed in detail. Representatives of *primates*, the highest order of mammals, to which man himself belongs, appeared in the Miocene Period, but the geologic record is singularly meager in regard to the origin of the human race. When geologists have had opportunity to study more carefully the tropical regions of the Eastern Hemisphere, the original home of the race, we may know more about this fascinating subject. It is also an unanswered question as to whether or not man existed in North America during the Pleistocene Period (see GLACIAL PERIOD), when thousands of square miles of its surface were covered by thick ice sheets. This and many other questions must be left to future investigations and discoveries. The forces that have brought the earth to its present condition have worked through unknown millions of years, and changes are still going on as the

earth pursues its unceasing course around the sun. It is possible that there will be another era in which man's spiritual and intellectual development will be comparable to the great physical and biologic evolutions of the past.

Geology and Mythology. We say, sometimes, without realizing that we are using figures of speech, that a volcano breathes out smoke; that the waves are angry; that a mountain lifts its head among the clouds; that the wind whistles; that the clouds threaten. With us, they are only figures of speech, but in the early days such expressions were more than that. The ancient Greeks and Romans lived in a region whose geological features could not be overlooked. It was no flat prairie country, the same to the north as to the south. There were mountains and mountain streams; there were volcanoes and earthquakes; there were chasms and rivers and deep, still lakes and the restless, wind-tossed sea; and for all of those things the active minds of the Greeks and Romans had to find explanations. To those ancient peoples everything was alive, not with merely human life, but with the life of gods. A man might blow a basin of water and make little waves upon it; what, then, more natural than that the wind, so like, on a large scale, the blowing out of a man's breath, should be the breath of some great god?

So they accounted for all the facts in nature which they saw about them. If they rose in the morning and found that the sea had become very stormy during the night and was hurling its great waves up on the shore, they felt that the sea god was angry, and they made offerings to him to buy back his favor. Anything so unusual as an earthquake or a volcanic eruption needed a very special explanation, so they invented histories that reached far back into the past, telling how the gods became angry with some huge giant and buried him under a mountain. His breath was the smoke of the volcano; his struggles to escape caused the earthquakes. A deep chasm or hole in the ground showed where some god had struck his spear, either in anger or because he wanted to get to the regions below the earth without taking a long way round. See MYTHOLOGY. E.S.

Consult Dana's *Geological Story Briefly Told;* Goodrich's *Wonders of Geology;* Heilprin's *The Earth and Its Story* (a first book in geology); Kingsley's *Madam How and Why—First Lessons in Earth Lore.*

Related Subjects. In addition to the following articles, which bear directly upon geology in some of its phases, these volumes contain many articles which are more or less closely related to the general subject. For these the reader is referred to lists under GEOGRAPHY: METALS; MINERALS AND MINERALOGY.

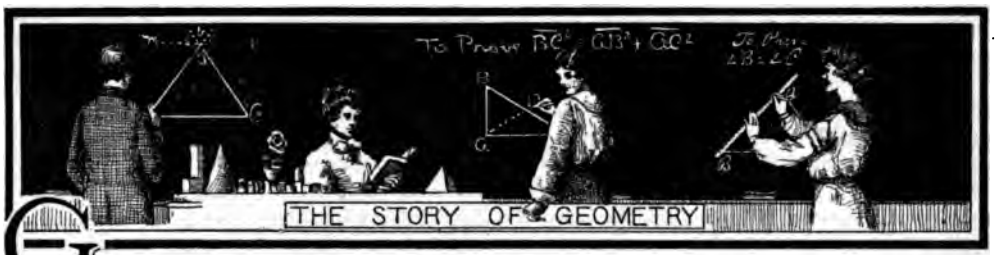
Algonkian System
Archean System
Azoic Era
Basalt
Bed
Boulder
Butte
Cambrian Period
Carboniferous Period
Cenozoic Era
Chalk
Clay
Coal
Conglomerate
Cretaceous System
Crystalline Rocks
Devonian Period
Diabase
Dike
Dinosauria
Dip
Dolomite
Drift
Eocene Period
Erosion
Fault
Flint
Fossil
Fuller's Earth
Geological Surveys
Glacial Period
Gneiss
Granite
Graphite
Gypsum
Hematite
Hornblende
Igneous Rocks
Joints
Jurassic Period
Kaolin
Limestone
Limonite
Marble
Mesozoic Era
Metamorphic Rocks
Metamorphism
Mica Schist
Minerals and Mineralogy
Miocene Period
Moraine
New Red Sandstone
Niagara Series
Obsidian
Old Red Sandstone
Ordovician Period
Paleozoic Era
Permian Period
Pliocene Period
Porphyry
Protozoic Era
Pumice
Quaternary Period
Ripple Marks
Rock
Sand
Sandstone
Serpentine
Shale
Silurian Period
Slate
Soil
Stratified Rocks
Tertiary Period
Trachyte
Travertine
Trenton Series
Triassic System
Tripoli
Tufa
Vein

GEOLOGISTS

Bell, Robert
Dana, James Dwight
Dawson, Sir John William
Geikie, Sir Archibald
Heilprin, Angelo
King, Clarence
Le Conte, Joseph
Lyell, Sir Charles
Muir, John
Powell, John Wesley
Shaler, Nathaniel S.
Tyndall, John
Van Hise, Charles Richard
Winchell, Alexander

PHYSIOGRAPHIC TOPICS

Air
Alluvium
Canyon
Climate
Coastal Plain
Delta
Desert
Divide
Dust, Atmospheric
Earth
Earthquake
Fall Line
Geyser
Glacier
Hill
Island
Lake
Mountain
Ocean
Physical Geography
Plateau
Talus
Tides
Tornado
Valley
Volcano
Wind

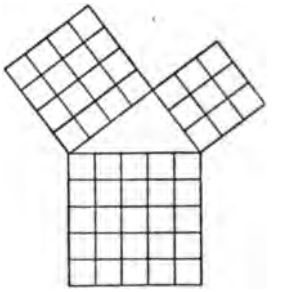


GEOMETRY, *je om' e tri.* A great city had fallen, and soldiers were rushing through its streets, putting to death all who gave them the slightest excuse. As one burly soldier crossed the market-place he saw, seated on the ground, an old man whose ears seemed deaf to the tumult around him and who seemed to see nothing but the figures he was tracing with his finger in the sand. The soldier stopped, wondering whether these might perhaps be magic figures, and as his shadow fell upon the markings the old man looked up. "Don't touch my circles!" he cried; but the soldier, angered at the commanding tone, ran him through the body with his sword. The general in command grieved over the death of this old man, took upon himself the support of his relatives, and erected in his honor a stately tomb. He did this despite the fact that the old man had done all in his power against the invaders in aiding in the defense of the city; for in such reverence did the ancients hold learning, and especially the marvelous science of circles and angles and spheres, which is called *geometry,* or *earth-measuring.*

The sacked city was Syracuse, in Sicily, which fell before the Romans in 212 B.C.; the drawer of the mystic figures was Archimedes, one of the greatest mathematicians of antiquity (see ARCHIMEDES). Geometry is not like that simpler form of mathematics which we call arithmetic—a comparatively modern science; the former existed in a fairly complete form two thousand years ago.

The Story of Geometry. It is probably true that geometry had its beginnings in practical problems. The ancient Egyptians, for instance, had great difficulty in preserving boundary lines between the fields which each year were flooded by the Nile, and when the waters subsided they had to make new surveys or "land-measures"—and hence the name *geometry.* Now in making these surveys it was very necessary that they know how to mark off correctly right angles. The Egyptians had never heard the rule which every student of arithmetic learns—that the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides; but they had worked out, no one knows how, the fact that if they measured off with their ropes a three-sided figure whose sides were in the relation of 3, 4, 5, the large enclosed angle would be a right angle.

In their plans for the pyramids, too, the Egyptians must have made use of many of the principles with which geometry concerns itself, but it cannot be said that they ever really developed a science of geometry. This was left for the Greeks to do. Thales was the first Greek to make a systematic study of the subject, but more famous than he was his disciple Pythagoras (which see), who worked out that proposition about right-angled triangles which the Egyptians had felt after blindly, and which is still called for him the *Pythagorean Theorem.* Philosophers found this new subject quite to their taste, and Plato and Aristotle contributed much to its development; but it was left for Euclid, a Greek of Alexandria who lived about 300 B.C., to win the title of "father of geometry" (see EUCLID). He organized everything that his predecessors had discovered, added new problems, and set forth all his knowledge in his *Elements,* a book on which the teaching of geometry has ever since been based. Indeed, his name is practically a synonym for *geometry.* "To-morrow's Euclid is hard," says the English schoolboy, and no one misunderstands him.



PYTHAGOREAN THEOREM

A figure which shows that the square drawn upon the hypotenuse of a right-angled triangle is equal to the sum of like squares drawn upon the other two sides.

The next really great geometrician was Archimedes, who died, as related above, in

212 B. C. His work was rather in solid than in plane geometry, and he had left a request, which was faithfully carried out, that there be cut on his tomb a sphere inscribed in a cylinder, because the working out of that problem he felt was his greatest achievement. All through the Middle Ages there was little interest in geometry, and though this was awakened at the time of the Renaissance no real advance was made in the science until within the last two centuries. It is useless to discuss in such an article as this these more recent developments, as they all relate to the more abstruse phases of the subject. Suffice it to say that the problems over which the schoolboy nowadays puzzles his brain are the very problems which interested Euclid.

What Geometry Concerns Itself With. The above discussion of the way in which geometry has developed does not really tell what it is. Perhaps the simplest definition is to say that geometry is the "science of space;" that is, it concerns itself with the relations and properties of *points,* which have position but not magnitude; *lines,* which have but one dimension, length; *surfaces,* which have two dimensions, length and breadth; and *solids,* which have three dimensions, length, breadth and thickness. This may sound at first rather theoretical, but geometry is an eminently practical subject. If a man wishes to bisect (cut in two equal parts) a given line or a given angle; to inscribe one figure in another; to drop a perpendicular to a line from a point without the line; to draw a line parallel to a given line through a given point; to make an angle equal to a given angle—to do any of these or a thousand other things which not only the architect, the stonecutter or the draughtsman, but the carpenter or the amateur craftsman may be called upon to do at any time, only geometry can help him to perform his task simply and accurately. Indeed, many of the problems which geometry has solved have grown out of just such popular needs.

Branches of Geometry. The geometry taught in secondary schools is called *elementary,* no matter how difficult and "advanced" it may seem to the student who is becoming acquainted with it for the first time; and elementary geometry is divided into two branches —*plane* and *solid* geometry. Plane geometry treats of all figures which lie in a plane—that is, which have not more than the two dimensions of length and breadth and have no part of their surface curved; while solid geometry treats of simple solids, or objects having the three dimensions of length, breadth and thickness, such as cylinders, cubes, spheres or cones. With any other curve than that of the circle, or with plane surfaces or solids bounded by any other curves, elementary geometry has nothing to do.

It was elementary geometry almost entirely to which the ancients who built up the science devoted themselves, but modern mathematicians have worked out two great systems in addition—*analytical* geometry and *projective* geometry.

Analytical geometry is in reality a sort of combination of geometry and algebra. The relations of geometric figures are expressed in algebraic terms, equations are formed and worked out just as in algebra, and the resultant equation is translated back into geometric figures. This makes possible the study of more complex curves than elementary geometry can deal with. First of all, the laws of conic sections may be understood by means of this algebra-geometry process. If a cone be cut in a plane parallel with its base, the cut surface is a circle, but if it be cut in any other way the surface resulting is bounded by less simple curves; and these less simple curves, or conic sections, as they are called, are favorite subjects of analytical geometry. Spirals, too, and wavy lines, cannot conceal their properties and their relations from the person who has mastered this higher form of geometry. The problems worked out are all too difficult for solution here, but it is interesting for even the beginner to know that such an all-embracing form of geometry does exist.

Projective geometry is abstruse enough in its working out, but in its principles it is simple. It studies not figures themselves, but their *projections.* Does that sound difficult? If, walking on a sunny day with the sun behind you, you look downward, you will see there your shadow, long or short according to the height of the sun. That shadow is your *projection,* and it is like you in some ways—it has a head and two hands and two feet; but it is not by any means a duplicate of your figure. Now there are certain laws which govern projections and their relation to the figure from which they are projected, and with these laws projective geometry concerns itself. Old maps are very quaint and hard to understand, because the ancients did not know anything about the projection of a sphere on a flat surface, which is exactly what map-draw-

ing amounts to; the earliest photographs were hazy and uncertain of line, because the men who made the first cameras did not understand well enough the projection of the sitter's face on the sensitive plate. There are also many other very important and practical applications of projective geometry. Of course it is not necessary for the schoolboy who toils over the map of Europe, or for the girl who delightedly "snaps" baby sister's picture with her kodak to know the underlying principles or even to know that there is such a thing as projective geometry; but the proper fulfilling of their tasks is possible just because somewhere, some time, wise men worked out those principles.

Terms Used. The student beginning elementary geometry finds himself brought face to face with many new and strange terms. In algebra, as in arithmetic, the things he was called on to solve were called problems. Here he hears talk of *propositions* and *theorems, corollaries, axioms* and *hypotheses,* or sees at the bottom of a solved "problem" the mysterious letters *Q. E. D.* or *Q. E. F.* A few definitions, however, will make all of these plain:

A *proposition* is the statement of some truth that is to be proved or of some operation that is to be performed. A proposition of the former type, which states some truth that may be logically demonstrated, is a *theorem;* one of the latter type, which proposes a question for solution, is a *problem.* Thus, "The sum of the three angles of a triangle is equal to two right angles" and "Construct a square equivalent to the sum of two given squares" are both propositions, but the former is a theorem, the latter a problem.

A *corollary* is a truth easily deduced from one or more propositions already proved. Thus, if it is true that the sum of the three angles of a triangle is equal to two right angles, it follows as a self-evident corollary that a triangle can have but one right angle or one obtuse angle.

A *demonstration* is the proof of a theorem; a *solution* is the process of solving a problem.

The *hypothesis* is the "if" part of a proposition—the part which states the thing or things taken for granted; the *conclusion* sets forth the things which are to be proved true. In the proposition *"If two sides of a quadrilateral are equal and parallel,* the figure is a parallelogram," the part in italics is the hypothesis, the rest the conclusion.

Q. E. D. is the abbreviation for the Latin words *Quod erat demonstrandum,* meaning "which was to be proved," and is placed at the close of the *demonstration* of every satisfactorily proved theorem.

Q. E. F. means *Quod erat faciendum,* or "which was to be done," and is placed at the close of the *solution* of any geometric problem.

One of the terms used very frequently in geometry is *axiom,* which means a *self-evident truth.* Geometry seeks to prove most things about the properties and relations of lines, surfaces and solids; it takes a few for granted, calling them true in the very nature of things. Who, for instance, would think of questioning the statement that "Things equal to the same thing are equal to each other"? That is an axiom, and there are many others, of which the following are perhaps most important:

1. If equals be added to equals, the results will be equal.
2. If equals be taken from equals, the remainders will be equal.
3. The doubles of equals are equal.
4. The halves of equals are equal.
5. The whole is greater than any of its parts.
6. The whole is equal to the sum of all its parts.
7. Between two points only one straight line can be drawn.
8. A straight line is the shortest distance between two points.

Then there are *postulates*—not quite so self-evident as axioms, but very clearly possible; and these, like the axioms, were set forth by Euclid and have helped to form the basis of geometric reasoning ever since. Some of the more important ones are as follows:

1. Any magnitute can be bisected.
2. A straight line can be continued indefinitely in either direction.
3. A circle can be drawn with any radius, and from any point as center.
4. A straight line can be drawn from any point to any extent in any direction.

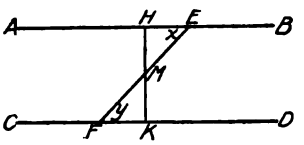
How Geometry Proves Things. Given a theorem to be proved, geometry goes about it in a very definite way. In the first place, nothing must be assumed. There must be proper authority for every step in the process; and proper authority lies only in an axiom, a postulate, a definition, or a proposition already proved. But all theorems are not proved in exactly the same way; there is a *direct* and an *indirect* method. The former consists either in superimposing one figure upon another, or in starting out with some unquestionable fact and proceeding step by step by means of axioms, postulates or theorems already proved to a conclusion which *must* be correct because every step in it has been taken with full authority. The following is a direct proof:

If two parallels are cut by a transversal, the alternate interior angles are equal.

Hypothesis: AB and CD are parallel lines, cut by the transversal EF.

Conclusion: Angle x=angle y.

Proof. Through M, the middle point of EF, draw HK perpendicular to AB.



HK is also perpendicular to CD. (It has been proved that "a straight line perpendicular to one of two parallels is perpendicular to the other."

Apply the figure MKF to the figure MHE so that the equal vertical angles at M shall coincide, MK falling along MH, and MF along ME. (It has been proved that all vertical angles are equal.)

Then F will fall on E,
for MF equals ME by construction;
and FK will fall along HE,
for FK and EH are both perpendicular to HK. (A previous theorem has proved that "from a point without a line, only one perpendicular can be drawn to the line.")

Therefore the angles x and y coincide and are equal, for by definition "the test of equality of any two magnitudes is that they can be made to coincide." Q.E.D.

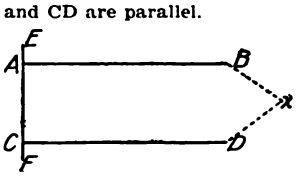
In an indirect proof something is assumed as true, and known truths and demonstrated propositions are built upon it until it is shown that if the original assumption be not true the result is an absurdity—a self-evident falsity. This method is known as the *reductio ad absurdum*, or *reduction to an absurdity*. The following demonstration gives a very simple example of this interesting method:

Two straight lines in the same plane, perpendicular to the same straight line, are parallel.

Hypothesis: AB and CD are two lines perpendicular to the line EF.

Conclusion: AB and CD are parallel.

Proof. Could AB and CD, if produced far enough, meet at some point, as x, there would be two perpendiculars drawn from the point x to the line EF. But this is impossible, for it has been proved that "from a point without a line only one perpendicular can be drawn to the line."



Therefore AB and CD cannot meet.
Therefore AB and CD are parallel.
For by definition, "lines in the same plane which cannot meet, however far produced, are parallel." Q.E.D.

It will be evident from these two examples that the order in which theorems are to be demonstrated is fairly well determined, for each demonstration must make use of only what has been proved before—it cannot reach forward to what is to come. In plane geometry, the simplest form and therefore the most interesting to most students, there are about 130 important propositions, but there are many minor propositions which are no less interesting, and many corollaries which are difficult to prove, no matter how simple they may appear to be.

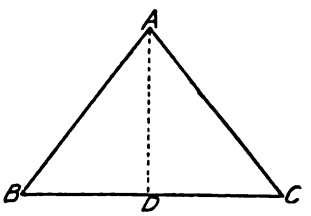
Some Famous Theorems. There are some theorems which are particularly famous, either because of some special difficulty, some neatness in the demonstration, or some historical interest. There is the *pons asinorum*, for instance, as "asses' bridge." From time immemorial, it seems, dull scholars have found difficulty with this proposition, which Euclid made the fifth in the first book of his *Elements*. Here it is, with its proof:

In an isosceles triangle, the angles opposite the equal sides are equal.

Hypothesis: ABC is an isosceles triangle, having AB equal to AC.

Conclusion: Angle B=angle C.

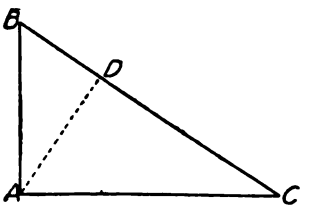
Proof. Draw AD bisecting the base BC.



The triangles ADB and ADC are equal;
for AD=AD, by identity,
DB=DC, by construction,
and AB=AC, by hypothesis;
and it has been proved that "two triangles are equal if the three sides of one are equal respectively to the three sides of the other."

Therefore angle B=angle C,
for it has been proved that "homologous angles of equal triangles are equal. Q.E.D.

Then there is the so-called Pythagorean Theorem, one of the most practical and useful of all the propositions of geometry — "The square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides." Simple enough it seems, when all the necessary preliminaries are proved, but its demonstration, with that of its necessary preliminaries, is one of the surest proofs that Pythagoras was a brilliant reasoner.



Hypothesis: BC is the hypotenuse of the right triangle BAC.

Conclusion: $\overline{BC}^2=\overline{AB}^2+\overline{AC}^2$.

Proof. Draw AD perpendicular to BC.

Then $\overline{AB}^2 = BC \times BD$

and $\overline{AC}^2 = BC \times DC$ (for it has been proved that "if in a right triangle an altitude is drawn to the hypotenuse, each leg of the triangle is a mean proportional between the hypotenuse and the adjacent segment").

Adding, $\overline{AB}^2 + \overline{AC}^2 = BC\ (BD+DC)$ or $= \overline{BC}^2$ (for by axiom, "if equals be added to equals, the results are equals"). Q.E.D.

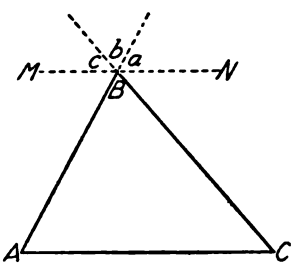
Another theorem which lies at the basis of many propositions in geometry, and which is also credited to Pythagoras, is the one which declares that:

The sum of the three angles of a triangle is equal to two right angles.

Hypothesis: ABC is any triangle.

Conclusion: Angle A+angle B+angle C= two right angles.

Proof. Draw MN through B parallel to AC, and produce AB and CB, forming angles *a*, *b* and *c*.



Then angle A= angle *a*, being corresponding angles of parallel lines, which have been proven equal;

and B=angle *b*, being vertical angles, which have been proven equal;

and angle C=angle *c*, corresponding angles of parallel lines.

Adding, angle A+angle B+angle C=angle *a*+ angle *b*+angle *c* (for by axiom "if equals be added to equals the results are equal").

But angle *a*+angle *b*+angle *c*=two right angles, for "the sum of all the angles that can be found at a point in a straight line and on the same side of the line, is equal to two right angles."

It is impossible to list here all the theorems which are especially interesting; indeed, the interest is not fully apparent when they are inspected in this disjointed manner. Only as the student follows logically from one theorem to the next can he feel the full joy that geometry has to give.

Why Geometry Is Studied in School. Geometry is usually accepted without question as one of the important subjects in a secondary school course. Few arguments have to be made for it, so apparent is its value. First of all, it lies at the basis of the whole science of measurement. To be sure, now that the theorems and problems have been fully worked out, the results have been in a measure passed on to arithmetic and are there stated as rules, so that a person may figure out the amount of carpet needed for a certain floor, the cubic capacity of a wheat bin or of a hogshead, the height of a tree, or many of the other practical problems without knowing the fundamental principles of geometry on which these problems are based. However, knowledge of geometry enables him to apply his rules far more intelligently, as well as to work out new applications for himself.

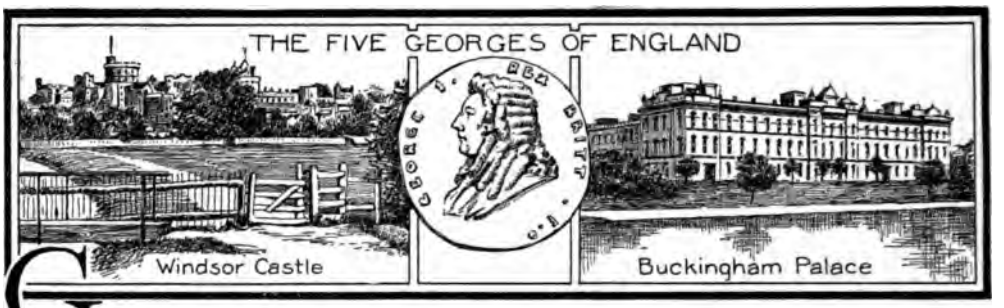
But geometry has other values, as important if not so practical. Its logical plan, the way it proceeds from step to step without allowing for any gap in the reasoning, develops the reasoning powers in a way impossible to any subject which admits of more hit-or-miss methods. Nor are all the theorems and problems of geometry worked out and set down in the textbooks for the student to memorize. Any good book contains a large number of original propositions which the student must work out for himself, and nothing proves more clearly his mastery, not only of geometric principles but of the workings of his own mind, than the ability to work out a theorem clearly and with the fewest possible statements make his demonstration clear to others. There is a joy which must be felt to be appreciated in detecting a fallacy or a gap in the reasoning, or in tracing out the definition, axiom or proposition which makes it plain that some elusive point is actually provable.

To sum up, no study can quite take the place of geometry as a cure for slovenly habits of thinking, and until some such substitute can be found it seems likely to hold its place, even for those who have no practical use for its teachings. A.MC C.

Consult Klein's *Famous Problems in Elementary Geometry;* Smith's *"History of Modern Mathematics"* in Merriman and Woodward's *Mathematics.* First books in geometry may be purchased from any schoolbook publishing house.

Related Subjects. In addition to the topics referred to in the above discussion, there are in these volumes many articles which are more or less closely connected with geometry. The reader is referred to the following:

Angle	Plane
Area	Polygon
Axiom	Prism
Circle	Pyramid
Cone	Quadrilateral
Cube	Rectangle
Curve	Rhomboid
Cylinder	Rhombus
Degree	Sphere
Ellipse	Square
Line	Square Measure
Magnitude	Trapezium
Mensuration	Triangle



GEORGE, the name of five kings of England, of the House of Hanover. The early Georges were unpopular because they were more German than English, but the present bearer of the name (George V) is an Englishman, with a strong hold on the affections of his people.

George I (1660-1727) came to the English throne on the death of Queen Anne in 1714. He was a great-grandson of James I of England, but his father was elector of Hanover and he had been born and brought up in Germany. In 1698 he succeeded his father as elector, and three years later was declared heir to the British crown. No opposition was made to his accession, but his utter lack of sympathy with England's traditions and ideals, as well as his loose morals, prevented any personal affection for him in Britain, while in the government he did not even pretend to exercise much influence. As he could not understand English, he did not attend the Cabinet meetings, and indeed, he preferred to spend his time among his old friends in Hanover rather than in his island kingdom. The chief event of his reign was the bursting of the "South Sea Bubble," and it was not the king but Walpole who saved England in that crisis.

George II (1683-1760) was the son and successor of George I. He, too, was born in Hanover, and was thirty-one years old at the time of his father's accession to the English throne. Thus he was almost as German in his sympathies as was his father. In 1708, while he was electoral prince of Hanover, he fought with distinguished gallantry under the Duke of Marlborough, and in 1727 came to the throne as king of Great Britain and Ireland. Walpole, Carteret and Pitt were among the men who guided the nation during the reign of this second George. To his credit it may [illegible] said that despite his obstinacy he was [illegible] willing to follow his ministers' advice if [illegible]d be convinced of its wisdom. Great colonial expansion marked George's reign, Clive laid the foundations of a vast empire in India, and Wolfe, by his victory on the Heights of Abraham, ended French control in North America and gave Canada to Britain.

George III (1738-1820). The reign of this third George is of peculiar interest to Americans, for at its beginning the thirteen English colonies in America were still possessions of England, discontented at times but on the whole loyal; while at its close they had become a prosperous and independent nation which had twice held its own against the mother-country in war. George III succeeded his grandfather, George II, in 1760, and proved in some ways very different from his predecessors. He was a man of high moral character, and his home life with his wife, Charlotte Sophia of Mecklenburg, was most happy. George had no intention of giving over the government to ministers—he wished to be the real ruler, though not in the absolute manner of the old Stuart kings. He tried minister after minister, but not until North was put in charge of affairs in 1770 did he find one exactly to his liking. For the twelve years that North was in office the king practically dictated the national policies, and it was largely his determined attitude toward the colonies that brought on the American Revolution. During the ministry of Pitt the war against France, which grew out of the excesses of the French Revolution, was vigorously prosecuted.

More than once during his long reign the king suffered from mental derangement, and in 1811 he became hopelessly insane. The Prince of Wales governed as regent, and on the death of his father in 1820 became king as George IV.

George IV (1762-1830). While he was yet Prince of Wales his immoral life, his unfilial conduct and his repeated attempts to divorce his wife, the Princess Caroline Amelia of Brunswick, had almost broken his father's

heart and had lost him the respect of the people; but through it all he bore the proud title of "the first gentleman of Europe" because of his gallant manner, his cleverness and his exquisite dress. In the important events of his reign, which included the Napoleonic wars and the passing of the Catholic Emancipation Act, he had little part. He left no descendants, and his brother, William IV, succeeded him.

George V (1865-) bears the sounding title of "George V, by the Grace of God of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, King, Defender of the Faith, Emperor of India." He was born June 3, 1865, and was the second son of Edward VII, but on the death of his elder brother in 1892 became heir prospective to the throne. Meanwhile, he had received a thorough training in the navy, starting at the age of twelve as cadet and enduring the same discipline as his shipmates. In 1893 he became captain, in 1901 rear admiral and in 1903 vice admiral, though after 1892 he was not in active service. He was married in 1893 to the Princess Victoria Mary of Teck, who has borne him six children, the eldest of whom, Edward, Prince of Wales, was born in 1894.

GEORGE V

Son of Albert Edward (Edward VII), grandson of Queen Victoria, and cousin of Emperor William of Germany and the former Czar Nicholas of Russia.

After his father's accession in 1901, George made a tour of the world, chiefly to acquaint himself with conditions in the British colonies, and on his return was associated with his father in governmental affairs. At Edward's death in 1910 he became king, the coronation taking place June 22, 1911. Unlike his father, King George is of a quiet, retiring nature, caring little for social affairs, and his people knew little of him at his accession. His popularity, however, was immediate and lasting.

Consult Thackeray's *Four Georges;* Melville's *The First George in Hanover and England;* Lucas's *George II and His Ministers;* Walpole's *Memoirs of the Reign of George III;* Melville's *The First Gentleman of Europe* (referring to George IV); Hudson's *Our Sailor King* (referring to George V).

Related Subjects. The following articles in these volumes contain much information as to the history of the period of the Georges:

Clive, Robert	Pitt, William
French and Indian Wars	Revolutionary War in America
Great Britain	South Sea Company
Subtitle *History*	Walpole, Sir Robert
North, Frederick, Lord	Wolfe, James

GEORGE, David Lloyd (1863-), a British statesman whose aggressive and virile personality has made itself felt in all the important reforms and events of recent English history. Could his character be summarized in a sentence, he would perhaps be described as a man with an intense and dominating love of democracy, and both his friends and his opponents would agree that he has a positive genius for getting things done. Only a man of decision and action could have sponsored or initiated in conservative England the great movements that are identified with his name—old-age pensions, insurance against sickness and nonemployment, educational and land reforms, etc.—or have attained the Premiership, as did he, at a time when England was involved in the most desperate struggle of modern times—the War of the Nations.

DAVID LLOYD GEORGE

The first Premier of Britain to come from the middle classes. He assumed a greater burden than ever fell to any of his predecessors.

This small, energetic, intensely earnest man is of Welsh descent. He was born in Manchester, the son of William George, a poor schoolmaster who died when David was about two years old. The mother, a daughter of David Lloyd, sent the boy to Wales, where he was reared by an uncle. The future Premier

adopted his mother's family name as a part of his surname, and has always called himself Lloyd George. He prepared himself for the profession of law, and as early as 1890, when he was only twenty-seven, he had become sufficiently well known to win a seat in Parliament. Yet it was ten years before he had opportunity to prove his ability. Late in 1899 England began war with the Boers in South Africa, and throughout the conflict that followed Lloyd George opposed the government with a vehemence and an indignation that made him the most hated man in the country. In fact, in 1900, he was mobbed in Birmingham while attempting to make a speech in the town hall. Then, after the war, public opinion changed, and the people began to estimate at their true value Lloyd George's high courage and uncompromising independence.

In 1906 he entered the Campbell-Bannerman Cabinet as President of the Board of Trade, carried on the work of that office with brilliant success, and in 1908 succeeded Herbert Asquith (which see) as Chancellor of the Exchequer. The next few years witnessed momentous changes in English constitutional history. Taking up the old-age pension bill which Asquith, then Premier, had already begun to advocate, Lloyd George saw it through its final passage, and then introduced into Parliament his famous budget of 1909. This provided for radical increases in the taxes of the well-to-do, as additional revenue was needed to carry out the various social reforms of the government. The rejection of this budget by the House of Lords, its passage by a newly-elected Parliament and the loss of the veto power by the House of Lords are matters of English history that will always be connected with the name of Lloyd George.

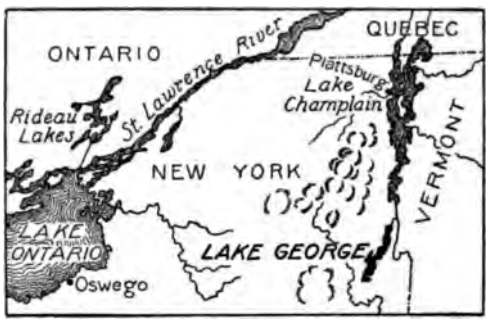
In 1911 this fiery little champion of the people's rights stirred the country with another great reform—insurance of the workingman against accident, sickness and unemployment. In 1913 he began a campaign to equalize the land rights in England, but ere the movement was fairly launched its sponsor was interrupted by a catastrophe that overshadowed all domestic matters—the outbreak of the great war. As was to be expected, the Chancellor of the Exchequer became a commanding figure in this new crisis. In May, 1915, when Premier Asquith formed the coalition Cabinet, Lloyd George was made head of the new Department of Munitions, and it is characteristic of him that in this position he told the officials of the War Office that he would multiply their program for manufacturing munitions by eight. Not only did he keep his promise, but eventually he multiplied it by sixteen, besides bringing a chaotic state of affairs to one of system and order. A year later, in June, 1916, when Secretary of War Kitchener was drowned, Lloyd George succeeded him as head of the War Department, and at the end of that year, in December, he took up the duties of the Premiership, relinquished by Asquith. According to a new arrangement, Lloyd George became head of the War Council, but resigned to Bonar Law the political leadership of the House of Commons. B.M.W.

GEORGE, HENRY (1839-1897), author of the economic theory of the single tax (which see), and one of the few Americans who has made notable contributions to economic science. The underlying doctrine of the single tax, that all men have equal right to the use of land, just as they have of air and sunlight, is not original with George, but he made the first clear statement of a method by which this right could be enforced without increasing the machinery of government.

From his fourteenth year George worked to support himself, and to the end of his life he was a poor man. He shipped as a foremast boy on a vessel bound for Australia, hunted gold in British Columbia, learned the printer's trade in California, and finally became a newspaper reporter and editor in San Francisco. As he matured he began to meditate on the economic conditions he saw about him, on the riches acquired suddenly by the fortunate owners of gold-bearing lands. It was here that he first realized that the individual landowner is seldom, if ever, responsible for the increase in the value of his property. His theories were first stated in a pamphlet, *Our Land Policy*, published in 1871. A more complete statement is found in his famous book, *Progress and Poverty*, published in 1879.

This book made George the prophet of a new social and economic creed, and the remainder of his life was devoted to lecturing and writing on the land question and other economic and political subjects. While not politically ambitious, he twice accepted an independent nomination for mayor of New York City, which was his home after 1883. He was defeated the first time, and died during his second campaign for this office, when victory seemed almost assured.

GEORGE, LAKE, a lake in the eastern part of the state of New York, which figured historically in two wars and was in turn under the control of the French, the English and the colonists during the early history of America.



LOCATION MAP

The lake has a length of thirty-six miles and a varying width of from one to three miles, and forms part of the boundary between Warren and Washington counties. It is one of the most picturesque lakes in the world and is a favorite summer resort. The head of the lake is at the town of Lake George, formerly called Caldwell, from which point it extends northeast and discharges into Lake Champlain.

During the French and Indian and Revolutionary wars, the vicinity of Lake George was a great battleground. Forts were built at Ticonderoga by the French and at the head of the lake by the English. The battle of Lake George was fought on September 8, 1755, between the French and the Indians. A monument was unveiled to mark the spot on September 8, 1903, the state of New York having purchased the land now known as Battle Park Reservation. Cooper, the novelist, called the lake Horicon, but the name was changed by General William Johnson in August, 1755, and that of Lake George was given, in honor of the English king, George III. See TICONDEROGA, BATTLES OF.

GEORGE, SAINT, the patron saint of England. The life of George is surrounded by legends and little is definitely known of him. Most accounts state that he was of Cappadocian parentage, but born in Lydda. He became a soldier and rose to high rank under Diocletian, but his open profession of Christianity led to his arrest, and after suffering cruel tortures he was put to death at Nicomedia, April 23, A.D. 303. Saint George was highly venerated by the Crusaders, and in 1350 was proclaimed the patron saint of England. The red cross of Saint George on a white background was long worn as a badge by English soldiers and is retained in the Union Jack (see FLAG). The familiar legend of Saint George and the Dragon arose from confusion of the Saint with Perseus, the pagan hero who slew the sea monster that threatened Andromeda (See PERSEUS). Saint George is also the patron saint of Russia and Portugal. In many European countries, though not regarded as a patron saint, George is venerated and has been made the tutelary saint of many orders.

In the United States there is a fraternal and benevolent order styled *Sons of Saint George*, with branches in most large cities. The object of this nonpolitical association is to further social intercourse and to assist those of English descent in America.

GEORGE ELIOT. See ELIOT, GEORGE.

GEORGE I (1845-1913), king of Greece from 1863 to 1913, was the second son of Christian IX of Denmark, and a brother of the Dowager Queen Alexandra of England. In 1862 the Greeks deposed their ruler, King Otto, and the following year the national Parliament elected to the kingship the Danish prince, who was then called William. Having gained the consent of his family and of Great Britain, France and Russia, under whose protection the kingdom had been established, Prince William ascended the throne in 1863 as George I. Four years later he married Princess Olga, daughter of the Russian Grand Duke Constantine. On March 18, 1913, just fifty years after he ascended the throne, King George was assassinated by a lunatic, during the Balkan War (see BALKAN WARS). He was succeeded by his eldest son, Constantine, Duke of Sparta. See CONSTANTINE I.

GEORGE JUNIOR REPUBLIC, a miniature republic in which boys and girls are the citizens and fill the offices, and in which some special duty is expected of every member. It has a constitution modeled on that of the United States, calling for an executive department, a legislature of two houses and a judicial department. This interesting community is near Freeville, N. Y., and was organized by William R. George for the purpose of giving to poor and unfortunate and even apparently incorrigible children the chance to grow into useful men and women. Mr. George had for several years conducted summer outings for the children of the city slums and had become convinced that only through aid in self-government could they be really benefited. Endow-

ment for his scheme was not difficult to secure, and in 1895 it was launched. For a year he was president, but since 1896 all offices have been held by the boys.

From twelve to eighteen is the admission age, and children from any part of the United States may be enrolled as citizens. All, no matter how young, must work, for "Nothing without labor" is the motto, and all under the age of sixteen must attend the school of the community. An attempt is made to encourage those who have a desire for further education to go on through high school and college, and some of its members have had successful and honorable college careers. For those for whom scholastic training holds no charms, however, there is a choice among numerous vocations. They may take up carpentry, blacksmithing, farming, plumbing or printing, while for the girls there is training in sewing, cooking, laundry work and other branches. In addition to the cottages in which the citizens live, the community has its schoolhouse, its bank, store, library, government building, restaurants and workshops.

Other junior republics have been founded elsewhere, but criticism as to the methods employed has by no means been lacking. By 1913 complaints became so persistent that the State Board of Charities took the matter in hand, and Mr. George gave up his position as overseer, with the result that the republic practically ceased to exist. A number of the men who were interested then got together, subscribed a new endowment fund, and requested Mr. George to assume control. With his acceptance of their request began a new era of prosperity for the community. A.MC C.

GEORGE'TOWN, the county town of Kings County, Prince Edward Island, noted chiefly for its lobster-packing industry. It is situated on the eastern coast of the island, forty miles east of Charlottetown, by rail, and forty-five miles north of Pictou, N. S., by steamer. Georgetown is an ideal summer resort, with fine facilities for fishing, bathing and shooting; it has a considerable trade in agricultural produce. The most prominent buildings are the post office and customhouse, the courthouse and the town hall. The population in 1916 was about 1,000.

GEORGETOWN, originally STABROEK, as a Dutch village, is the capital of British Guiana, and is on the east shore of the Demerora River where it reaches the Caribbean Sea, in latitude [redacted]° 24″. The population in 1915 was 53,176. The city is regularly built, with wide, shady streets, through some of which flow cooling canals. The buildings, of wood or of brick and plaster, are airy and comfortable, and the city is characterized by neatness and sanitary care. The principal government building is of Elizabethan form. Georgetown has both Anglican and Roman Catholic cathedrals, an immense hospital, a fine museum rich in native fauna, a botanical garden (suburban), and many wharves built out into the river for ocean ships. There are electric lights and street cars and a good telephone service. Water for drinking is obtained from rainfall, but for protection against fire and for many other purposes is supplied through mains in the streets.

Georgetown has foundries, and various factories for making cigars, rice products, chocolate, and articles for local domestic use. Its chief connections are by water, along the coast and up the rivers. The production of gold in the colony in 1912 reached $879,800. The city is prosperous and well governed, but the property qualification reduces the voters to a very small part of the population. The Portuguese are very numerous, and own about two-fifths of the real estate.

GEORGETOWN UNIVERSITY, a Jesuit educational institution at Georgetown, D. C. (now a part of Washington), was founded in 1789, and in 1815 was given authority by Congress to confer degrees. Since 1833 it has had Papal consent to give degrees in philosophy and Catholic theology. The university maintains a college, a graduate school, a medical and dental school, a law school and an astronomical observatory.

GEORGE WASHINGTON UNIVERSITY, an institution of higher education located at Washington, D. C., the successor of the Columbian College of the District of Columbia, which was chartered by Congress in 1821. In 1873 the name was changed to the Columbian University, and in 1904, by act of Congress, the school became the George Washington University. The old Columbia College was under the control of the Baptist Church, but when the present name was adopted the institution was made undenominational.

The university embraces the college of arts and sciences, school of graduate studies, Columbian College (for undergraduates, with courses leading to the degrees of bachelor of arts and bachelor of science), college of engineering and mechanic arts, teachers college, the departments of law, medicine and dentistry,

and the associate colleges. The latter, which have separate boards of trustees, consist of the colleges of pharmacy and veterinary medicine. The institution is maintained largely by friendly subscription pledges and by tuition fees. The location of the university buildings in the heart of the city gives the students ready access to the valuable materials collected by the national government in its museums, libraries, laboratories and archives. About 1,350 students are regularly enrolled, and the staff of instructors numbers about 180.

GEORGIA, *jor'ji a,* a South Atlantic state of the United States, known popularly as THE EMPIRE STATE OF THE SOUTH. It was the largest of the original thirteen states, and is still, with its area of 59,265 square miles, the largest state east of the Mississippi River. To the north of Georgia are Tennessee and North Carolina, to the east South Carolina and the Atlantic Ocean, to the south Florida and to the west Alabama. The Savannah River forms almost the entire boundary between Georgia and South Carolina, and the Chattahoochee about half of that between Georgia and Alabama. For the state flower the school children selected the Cherokee rose, one of the most beautiful of all roses, which grows abundantly in the state. In August, 1916, the legislature legalized the choice.

The People. In size the nineteenth among the states of the Union, Georgia ranks tenth in population, and among the Southern states is second only to Texas. In density of population, however, it ranks above Texas, and is in turn surpassed in this respect by Kentucky, North and South Carolina, Virginia and Tennessee. At the formation of the Union, Georgia had 82,500 inhabitants; in 1910 it had 2,609,121, while its estimated population in 1916 was 2,860,209. White people do not greatly predominate, for in 1910 there were 1,431,802 whites and 1,176,987 negroes. There are some counties, especially in the central parts of the state, where there are more negroes than whites.

In Georgia, as in most of the other Southern States, a large proportion—almost four-fifths, in fact—live under what may be called rural conditions; that is, either on farms or in towns of less than 2,500 people. In this proportion, however, there is a tendency to shift, the urban population increasing much more rapidly than the rural. Four cities have a population of more than 25,000: Atlanta, the capital and largest city; Savannah, near the mouth of the Savannah River, the chief seaport; Augusta and Macon, important centers of the cotton industry. Other cities of note are Columbus, Athens, Waycross, Rome and Brunswick. Some of these have had a remarkable growth since the beginning of the twentieth century, Waycross increasing over 150 per cent between 1900 and 1910.

This Empire State of the South differs very decidedly from the Northern Empire State, New York, in its proportion of foreign-born inhabitants. In the latter this is very large, while in Georgia but six-tenths of one per cent of the population are of foreign birth. Thus far, it has been almost entirely unknown soil to the immigrants.

Education and Religion. To say that the percentage of illiteracy in Georgia is 20.7 does not give a fair idea of the progressiveness of the state, for it is the large proportion of negroes which makes it so high. In comparing statistics it must be remembered that there are more colored people in Georgia than in any other one state. Among the whites, only seven people out of one hundred are unable to read and write. As in the other Southern states, the educational problem is difficult of solution, not only because of the negroes, but because the rural population is so large. There is no compulsory education law in the state, but every possible effort is made to convince the people of the value of schooling. The public school system, which includes primary, secondary and collegiate schools, is becoming

better every year. In the larger cities and towns there are graded and high schools for both white and colored children, and the total enrollment of colored pupils is about two-thirds that of the white.

The University of Georgia (which see), which admits only men, is a part of the public school system. Among other institutions of higher learning are the South Georgia State Normal College at Valdosta, the State Normal School at Athens, the Georgia School of Technology at Atlanta, Andrew Female College at Cuthbert, and many other schools of academic or college rank.

Religion. Among religious sects, the Baptists are by far the strongest, having more members

GEORGIA

The map shows boundaries, locates the highest point of land in the state, names the principal rivers and the leading cities, and shows the locations of mineral wealth.

than all the other churches combined. Next in order are the Methodists, of whose 300,000 members about one-third are colored. The founder of Methodism, John Wesley, visited the colony with his brother Charles in 1736, and George Whitefield, one of the most powerful preachers of that denomination, founded an orphanage near Savannah in 1738, but it would be incorrect to trace the strength of Methodism in the state to these early in-[illegible]es.

Surface Features. The different topographical regions of Georgia are well marked, though in general it may be said that there is a gradual slope from the northern part toward the coastal plain in the southeast. In the north a triangular section with an area of about 6,000 square miles is crossed from northeast to southwest by the Blue Ridge Mountains. These are not towering peaks, the greatest elevations not reaching 6,000 feet, but their abrupt valleys, steep cliffs and domelike summits make up a scenic region of surpassing beauty. In the extreme northwestern corner, in that portion of the Cumberland Plateau which projects into the state from Tennessee, is located Chickamauga National Military Park, a memorial of the great battle fought on September 19 and 20, 1863. The area of the park itself is fifteen square miles and the roads for miles on each side of it have been beautified and made a part of the park system. Monuments and tablets at various points make clear the maneuvers of the battle, and at places the forest-growth which covers the park has been cleared away, that the movements may be traced.

On the south the Blue Ridge district gradually gives way to the Piedmont Region (which see), a section of rolling country diversified with broad hills and narrow valleys. The northern edge of this region is about 1,500 feet in altitude, but at the fall line, where the land drops to the coastal plain, it is only about 300 feet. The direction of this fall line may be interestingly traced on the map, for its course across the state is marked by a line joining the cities of Columbus, Macon, Milledgeville and Augusta. These cities do not just happen to be at the fall line—they were located there that they might take advantage of the excellent water power which the drop in the rivers furnishes (see FALL LINE).

Stretching away to the southeast is the coastal plain, with an area more than half that of the entire state. For the most part this is low and level, but here and there occur ridges and valleys which seem like miniature mountain ranges. In the southeastern corner, extending into Florida, is the Okefinokee Swamp, one of the largest swamps in the United States. Low marshy tracts, where moccasin snakes and alligators abound, are interspersed in this great swamp region with islands overgrown with trees and dense underbrush. It has never been fully explored, for its dangers are as numerous as its beauties.

Rivers. Georgia has 540 square miles of water surface, and is one of the best watered of the states. The rivers of the northwestern valley region and those which are confined to the coastal plain are for the most part rather sluggish, but most of the great rivers might join the Chattahoochee in its wonderful *Song*, as written by Sidney Lanier, the Georgia poet:

> I hurry amain to reach the plain,
> Run the rapid and leap the fall,
> Split at the rock and together again,
> Accept my bed, or narrow or wide,
> And flee from folly on every side
> With a lover's pain to attain the plain;

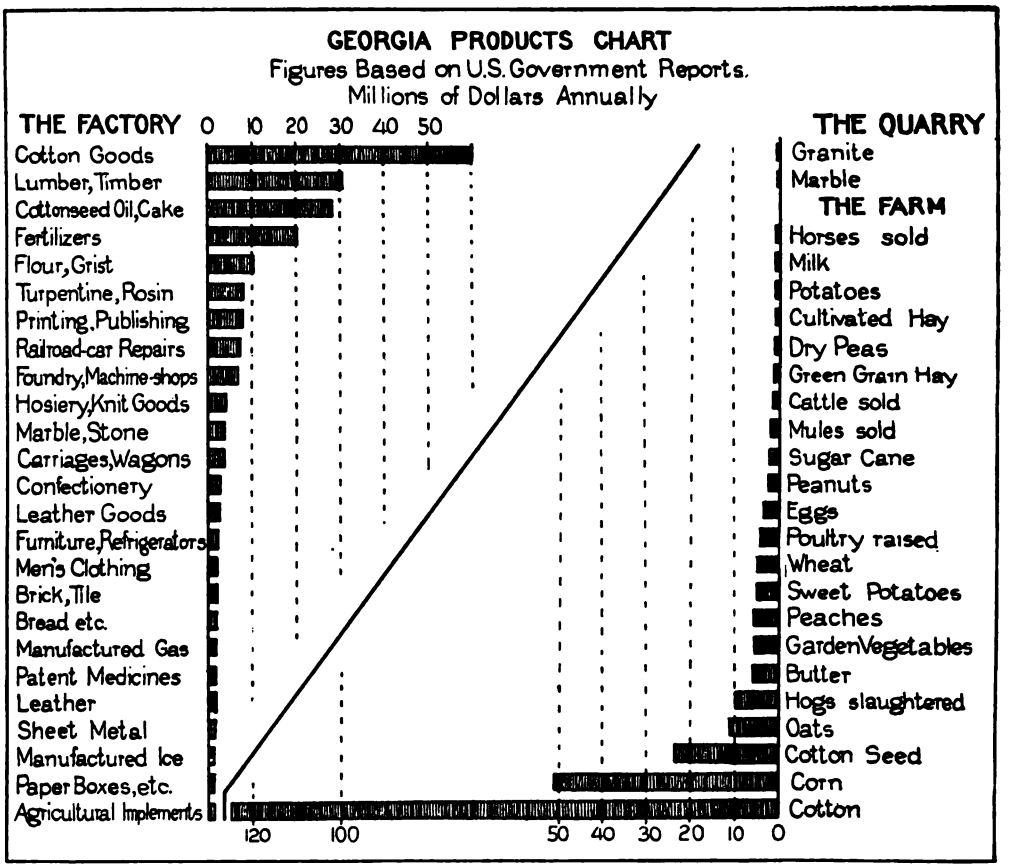
for they rise in the mountains, cross the Piedmont Region, and finally find their way to the plain, where they are large enough to carry down to the Atlantic or the Gulf of Mexico the traffic of the territory through which they flow. The extreme northernmost portion of the state is drained into the Tennessee, and thence by a roundabout course through the Mississippi into the Gulf of Mexico, but most of the drainage of the state finds its way directly to the Atlantic or the Gulf. The large rivers are, from east to west, the Savannah; the Altamaha, formed by the junction of the Oconee and the Ocmulgee; the Flint and the Chattahoochee. The first two empty into the Atlantic, the Flint joins the Chattahoochee just at the boundary line of Florida, and the last-named river, through this latter part of its course called the Apalachicola, finds its way to the Gulf.

Manufactures. The manufactures of the state are best considered in connection with its rivers, for it is the rivers which have in large part made them possible. Excellent water transportation, and a possible water power of at least 500,000 horse power, have combined to make this the foremost industrial state of the South. Especially since 1890 have manufacturing enterprises increased. In 1899, the total manufactured products amounted to $94,532,000, while in 1909 these had increased to $202,863,000 and in 1914 to $253,320,000. In this last year almost 120,000 persons were employed in the various establishments within the state.

It would almost be possible, by a study of the other industries of Georgia, to assume what the chief manufacturing enterprises must be. The state is a great cotton producer, and cotton goods rank far ahead of any other manufactured product. Sixty-seven per cent of the surface of the state is under forests, and lumber and timber products rank second. Other manufactured products of importance are fertilizers, cottonseed oil and turpentine and rosin. These all depend either on the growth of cotton within the state, or on its wooded character.

Mining. Georgia is particularly fortunate in having such abundant water power in certain sections, as its supply of coal is not extensive, and only a few hundred thousand tons are mined each year. Indeed, the mineral wealth of the state is not great. Iron, the only metal of any considerable importance, is even less valuable than coal. A little gold is found, seldom as much as $20,000 worth in a year. By far the chief mineral products are clay, excellent in quality and suitable for brick and tile, and building stones of various kinds. Especially important is the marble, that found in the northwestern part of the state being the purest and whitest produced in the United States.

Its Agriculture. The chief industry of the state is agriculture, which in the present century has advanced even more rapidly than manufacturing. Georgia's crops in 1899 were worth only $86,000,000, but by 1915 they had risen in value to more than a quarter of a billion dollars yearly. Because the climate shows a decided variation, a wide range of crops can be produced. The soils, too, most of which are very fertile, are various. On the coastal plain where the climate is mild and delightful, and the growing season nearly nine months, cotton is raised in vast quantities—the sea-island, or long-fiber, variety on the islands along the coast and the upland variety farther inland. Until recently cotton formed over two-thirds of the total crops of the state, and Georgia is second only to Texas in its production, with a yield usually nearly a million bales ahead of any other state. But a state dependent upon a single crop for its income passes through alternate periods of prosperity and poverty, and Georgia farmers have been quick to see this. Increasing acreage has been given to corn, which now yields the state about $50,000,000 a year, sometimes more than half as much as cotton. Oats, too, have advanced in value from $4,000,000 in 1909 to about $12,000,000, while wheat brings about $4,000,000 instead of less than $1,000,000. Of the other field crops hay, sweet potatoes, peanuts and sugar cane are important; the last two grow almost entirely in the southwestern part of the state. Georgia and North Carolina lead the other states in sweet potato production.



Georgia peaches are known everywhere, and the state often stands second to California in the number of bushels picked. In the present century the annual yield has increased from about a quarter of a million to over five million bushels. Other fruits are of less importance, though one of them, the pomegranate, grows in very few states. Pecans flourish both on the coast and in the inland counties.

In the mountainous portion of the state there is an abundance of pasturage for sheep and cattle, and hogs are numerous in the wooded districts.

In all, nearly three-fourths of the land of Georgia is called farm land, but less than one-third of this is actually cultivated, much of it being in forests. Many of the smaller farms are operated by negroes, either owners or tenants, and there has been a really remarkable development along agricultural lines of the [redacted] people of the state in recent years.

[redacted]ce has been made above to the forests of Georgia. These are to be very part of the state, but their composition differs in different localities. The *Song of the Chattahoochee,* quoted here, describes accurately the northern forests:

> The hickory told me manifold
> Fair tales of shade; the poplar tall
> Wrought me her shadowy self to hold;
> The chestnut, the oak, the walnut, the pine,
> Overleaning with flickering meaning and sign,
> Said "Pass not, so cold, these manifold
> Deep shades of the hills of Habersham,
> These glades in the valleys of Hall.

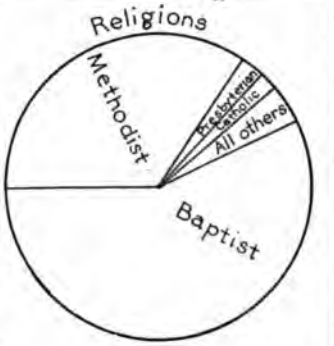
In the southern part, on the other hand, the forests are chiefly of the famous Georgia pine, the most important tree of the state.

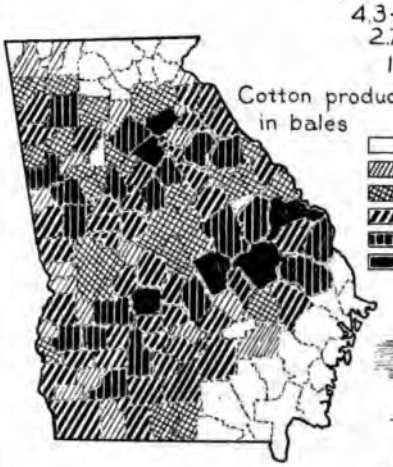
Transportation and Trade. Georgia has, as stated above, a large number of navigable rivers, but that it is not dependent upon these is proved by the fact that its greatest city, Atlanta, the "Gate City of the South," is not on or near a waterway. Indeed, the rivers are being less and less used for transportation as the railroad mileage increases. There are at present in the state over 7,300 miles of excellent railway, the Central of Georgia, the Southern Railway, the Seaboard Air Line and

GEORGIA

People per sq. mile By decades

44.2	1910
37.5	1900
30.9	1890
26.1	1880
20	1870
17.9	1860
15.3	1850
11.7	1840
8.7	1830
5.7	1820
4.3	1810
2.7	1800
1.4	1790





Oglethorpe's Fort
Saint Simon's Island

University of Georgia

the Atlantic Coast Line having the greatest mileage. Atlanta, Savannah, Augusta, Macon, Columbus, Athens and Waycross have become important railroad centers, and Savannah is also one of the chief seaports of the South. In the harbor of the city the United States government has excavated a channel twenty-six feet deep.

The commerce of Georgia with the other states is large, chiefly owing to its production of cotton and marble; for, while the manufacture of cotton products is ever increasing, by no means all the raw material is used in the state. Cotton goods, too, are exported, as well as lumber and other forest products, while the imports consist of those manufactured articles and food products not raised with profit.

Government. Georgia is governed under a constitution which dates from 1877. Since that time no exceedingly important amendments have been made, but the legislature of 1907 passed several statutes which are of the utmost importance. One of these, which went into effect on January 1, 1908, in spite of violent opposition, provided for statewide prohibition; the other concerned itself with suffrage. By the terms of the latter law, which had as its object the elimination of the negro vote, no one has the right of suffrage unless he can read intelligently or write accurately from dictation a paragraph from the Federal or the state constitution. That this may not deprive illiterate white citizens of the vote, there are other provisions, which allow certain property or patriotic qualifications to take the place of the educational one.

The executive department of the government is in the hands of a governor, secretary of state, comptroller, treasurer, attorney-general, commissioner of agriculture, state superintendent of schools, state geologist and state librarian, all of whom are elected for two years. After he has served two terms consecutively, the governor may not be reëlected for four years.

The legislative department consists of a house of representatives and a senate, the latter body having forty-four members and the former not more than 184. Members of each house are elected for two years and the legislature holds annual sessions of not more than fifty days.

The judicial power is vested in a supreme [illegible] consisting of a chief justice and five associates, chosen for six years by popular vote; [illegible]urt of appeals composed of three members, also elected by the people for a term of six years; and superior courts, which are held in each judicial district. There are also courts of ordinary, justices of the peace, and solicitors-general for each judicial district.

History. Georgia, which was named for George II of England, was the most southerly of the thirteen original colonies. Its territory was explored in 1540 by De Soto, and in 1562 Ribault sailed along its shores. The Spaniards, seeking everywhere for gold, sank their mines in its mountains, and though they found no gold they discovered traces of other metals sufficient to lead them to oppose the efforts of the English to seize the land, for Georgia was a part of the original Carolina grant.

Colonial Period. In 1732 the British government ceded the territory to a company organized to "establish the colony of Georgia in America," and very early in the next year James Oglethorpe landed with his first colonists. His object was to found a settlement where poor debtors from England and Protestants who had been driven by persecution from Europe might find a refuge. Savannah was established in 1733, but even under its liberal government the colony was not exceedingly prosperous. The Spaniards of the neighboring territories never ceased their aggressions, and in 1740 the Georgian colonists were involved in actual war with them, proving themselves, though unsuccessful, brave and skilful fighters.

Oglethorpe returned to England in 1743, and affairs in the colony became worse and worse. Slavery and rum, which by the original rules of the colony were forbidden, were introduced in 1749. Three years later the colony gave up its charter, and was organized as a royal province under the control of the British Parliament. If left to itself, Georgia would have continued quietly under this rule, for there was little cause for complaint given; but the spirit of the other colonies affected it also, and it sent delegates to the Continental Congress. During the War of the Revolution that followed, Georgia bore its part, and as a result suffered at the hands of the British.

Early Years of Statehood. In 1778 Georgia ratified the Articles of Confederation, and ten years later was among the first to ratify the Federal Constitution. The most pressing questions in these early years of statehood concerned the Creek and Cherokee Indians, who during most of the history of the colony had been distinctly unfriendly. Control of the Indian lands was eagerly sought, and in 1802 the

RESEARCH QUESTIONS ON GEORGIA

(An Outline suitable for Georgia will be found with the article "State.")

How is one of the great conflicts of the War of Secession commemorated in this state?

Why does the fact that there are many streams with a rapid fall mean more to Georgia than it would to Pennsylvania?

Discuss briefly the dependence of Georgia's manufacturing industries upon its natural resources.

Who was chiefly responsible for the strong Union sentiment that existed in the state at the outbreak of the War of Secession?

What notable religious teachers visited the colony in its early days?

If Georgia's chief crop were destroyed, who besides the planters would suffer? Would it make much difference outside of the state?

Give and account for a popular name that is applied to the state and one that is applied to its capital.

What were the chief Indian tribes of the territory? What was the cause of the friction between them and the white inhabitants?

What makes the educational problem a difficult one in this state? What attempts are being made to solve it?

How large a percentage of the population is employed in the industrial establishments of the state?

If you should suddenly open your eyes in a Georgia forest, how would you know whether you were in the northern or the southern part of the state?

What brought about a change for the worse in the condition of the colony about 1749?

What state of the North bears a popular name much like that of Georgia? How do the two states differ as to the character of their population?

What great river of the state receives a new name as soon as it crosses the boundary?

How large a part of the so-called farm land is actually under cultivation? Is the remainder mere waste land?

Who founded the colony of Georgia? How did it rank among the original colonies as to age? For whom was it named?

How many cities have more than 25,000 people? Is the tendency of the inhabitants towards the farm or towards the city?

What fruit raised in Georgia is famous throughout the country?

Who was the first white man to explore the territory? What was the aim of the Spaniards in establishing settlements?

How many states are larger than Georgia? How many of these are east of the Mississippi? How many Southern states have a greater population?

Why has the tendency been of late towards diversified farming rather than towards an increase in cotton production?

What sort of a region is Okefinokee Swamp? Why has it never been fully explored?

What were the most important legislative enactments of the early twentieth century?

What is the state flower?

How many states raise more cotton?

state gave up to the Federal government all its territory west of the Chattahoochee in return for the promise that the title of the land should be gradually taken away from the Indians and vested in the state. This did not settle the matter, however, and at intervals open warfare broke out, while conflicts between the state and Federal governments were frequent. But in 1832 the Creeks were driven out, and six years later the last of the Cherokees removed from the territory.

War and Reconstruction. Though Georgia was industrially as dependent upon slave labor as were the other Southern states, and though it held most firmly to the conviction that the Federal government had no right to prohibit slavery in a territory or to refuse admission to a slave state, there existed a strong sentiment in favor of the Union. The leader in this was Alexander H. Stephens, one of the strongest and most capable men that the South developed during the war period. Despite his efforts, however, the election of Lincoln was followed by the calling of a convention, which on January 19, 1861, passed an ordinance of secession, 208 delegates voting for it and eighty-nine against it.

During the war Georgia was the scene of important military operations (see WAR OF SECESSION), including Sherman's march "from Atlanta to the sea," and few, if any, of the states suffered more. Four-fifths of the public property, it was estimated, was destroyed during the raids of the Northern forces, and the commercial depression that followed was very serious. Nor did the reconstruction policy inaugurated by President Johnson better matters. Carpetbaggers (which see) gained control of the government, and the wealth of the state was wasted in reckless speculation and in frauds. Within three years the public debt was increased from $5,000,000 to $16,000,000, and the accusations of embezzlement against men in high government positions were not in all cases unfounded. The ordinance of secession was repealed and a new constitution adopted, but Congress, as was natural under the circumstances, objected to the attitude of the state toward the negroes, and set up military rule; and not until the beginning of 1871 was the state finally readmitted.

Recent Development. The history of the state since the Reconstruction period has been largely one of progress and development of the abundant resources. Two expositions, one in 1881 and one in 1898, were held at Atlanta, and both gave evidence of the prosperity of the state and of the large part which cotton was likely to play in its further development. The growth in manufactures, considerable as it is, has but begun, and the industrial future of the state appears most promising.

Politically, Georgia has been since 1871 almost uniformly Democratic, though between 1890 and 1898 the Populists gained a strong influence. In 1907 Hoke Smith, who had been Secretary of the Interior in President Cleveland's Cabinet, became governor, and it was he who signed the prohibition bill which went into force the next year. He also actively supported a far more popular legislative act—that which took the vote from the negroes (see *Government*, above). A.MC C.

Other Items of Interest. The prohibition law forbids the sale within the state of periodicals carrying liquor advertisements, and more than one newsdealer has paid a substantial fine for violation of the provisions.

In 1916 there was reopened near Atlanta the university named for the founder of the colony, Oglethorpe. This was originally established in 1835, but was forced to close its doors during the War of Secession, and had never before attempted to reorganize.

Recently the state has been devoting much attention to improving its unprogressive mountain sections, with a view to stamping out illiteracy. Better rural schools, night classes for adults, and extensive new highways form a part of the scheme.

The state owns the Western & Atlantic Railroad, which it built before the War of Secession. It is leased to the Nashville, Chattanooga & Saint Louis Railway until 1919.

Georgia was the latest founded of the thirteen original colonies.

Scientists recognize in the United States nine climate belts, and Georgia has examples of all but one of these. The lowest, which has an average yearly temperature of less than 40°, is to be found only on the mountain tops.

Georgia was the home of Eli Whitney at the time of his invention of the cotton gin.

Consult Harris's *Stories of Georgia;* Derry's *Story of Georgia;* Brooks's *History of Georgia.*

Related Subjects. The following articles in these volumes will help the reader to gain a more detailed knowledge of the state of Georgia:

CITIES AND TOWNS

Albany	Atlanta
Americus	Augusta
Andersonville	Brunswick
Athens	Columbus

Macon	Savannah
Rome	Waycross
EDUCATION	
Georgia, University of	
LEADING PRODUCTS	
Corn	Nut
Cotton	Peach
Lumber	Peanut
Marble	Sugar Cane
Melon	Turpentine
RIVERS	
Chattahoochee	Savannah
SURFACE FEATURES	
Appalachian Mountains	Piedmont Region
Blue Ridge	Stone Mountain

GEORGIA, a region celebrated for the beauty of its women and the strength of its men, containing the Russian provinces of Armenia, Caucasus and part of Asia Minor, lying between the Black and Caspian seas. This territory was surrendered to Russia by its king, George XIII, in 1798. The first authentic history of Georgia traces back to Alexander the Great. At the close of the second century the crown was given to the king of Armenia. The Arab invasions began a century later, and for two hundred years the inhabitants of Georgia were compelled to accept the Mohammedan religion at the point of the sword. Political relations between Russia and Georgia began in 1492 when the king sought protection of Ivan III of Russia during a war between the Persians and Turks. Early in the eighteenth century assistance was asked of Peter the Great, and in 1829, Guria, the last state of Georgia, submitted to Russia. Wine, cotton and fruit are produced in this region.

GEORGIA, UNIVERSITY OF, the oldest state university in the United States, located at Athens, Ga. It was chartered in 1785, but was not formally opened until 1801. According to the provisions of its charter, the primary and secondary schools of the state have an official connection with the university; it is also at the head of the public school system.

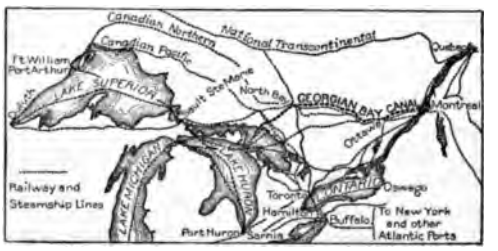
The institution includes the following colleges and departments: at Athens, Franklin College of Liberal Arts, the state agricultural college, the graduate school, the law department and the state normal school; also, the North Georgia agricultural college, at Dahlonega; the medical college, at Augusta; the school of technology, at Atlanta; the normal and industrial school for girls, at Milledgeville; the South Georgia state normal college, at Valdosta; and the Industrial College for Colored Youths, at Savannah.

The total enrollment of students in all departments is about 650, and there are about seventy members on the faculty. The university library contains 45,000 volumes. Except in the professional schools, tuition is free to residents of the state.

GEORGIAN, *jor'ji an,* **BAY,** formerly called LAKE MANITOULIN, an arm of Lake Huron, lying wholly in the province of Ontario. It extends eastward from Lake Huron, from which it is almost completely shut off by Manitoulin and other islands and by the Bruce Peninsula. Between Manitoulin Island and the mainland on the north is the North Channel, a picturesque little strait, with rocky bluffs along the shore. The eastern shores of the bay are low and rocky, but on the north they are high and bold, like the north shore of Lake Superior. The most striking feature of the bay is the vast number of small islands, said to exceed 20,000, which dot its waters. The attractiveness of these islands for summer homes and hotels is drawing a rapidly increasing number of temporary residents, with the result that Georgian Bay is perhaps best known as a summer resort.

Georgian Bay is about 120 miles long and fifty miles wide, and in many places exceeds 300 feet in depth. Numerous rivers empty into it, chief among them being the French, from Lake Nipissing; the Muskoka, from the chain of lakes of that name, and the Severn, from Lake Simcoe. The Trent Canal, though now only of local use, will provide a through water route from Georgian Bay to the Bay of Quinte on Lake Ontario, and the Georgian Bay Ship Canal will provide a through route to Montreal.

Georgian Bay Ship Canal. A ship canal to connect Montreal directly with Lake Huron has long been under consideration. In 1904 a



GEORGIAN BAY SHIP CANAL
Showing, also, its rail and water connections, if proposed plans are followed.

board of engineers was appointed by authority of the Dominion Parliament to investigate, from an engineering point of view, the practicability of the proposed waterway. The

s report, issued in 1909, established the ility of the canal and submitted details waterway 440 miles long, with a mini- channel of twenty-two feet. The canal d begin at the mouth of the French River, ie northeast corner of Georgian Bay, follow river to Lake Nipissing, then pass through number of small lakes to the Ottawa River d down the Ottawa valley to Montreal. iere would be twenty-eight miles of canal cavation, sixty-six miles of channel dredging, nd 346 miles of lake and river. The plans all for twenty-seven locks of a minimum length of 650 feet, with a clear width of sixty-five feet and a depth of twenty-two. The total fall from the summit, east of Lake Nipissing, to the Saint Lawrence at Montreal is 659 feet. The minimum water supply in the summit basin would permit twenty lockages a day throughout the season of about 210 days.

The canal would shorten the water route from Montreal to Lake Superior ports by 282 miles, and from Montreal to Lake Michigan ports by 270 miles. The cost of this undertaking is estimated at $125,000,000. Before pledging itself to the expenditure of this vast sum, the Dominion government determined to investigate the commercial feasibility of the canal, and in a general way the relation it would have to the transportation problems in Canada. For this purpose the Georgian Bay Canal Commission was appointed in 1914. Its preliminary report appeared in 1916. W.S.E.

GERANIUM, *je ra'ni um,* a hardy, flowering house or garden plant cultivated throughout America and Europe, but originally a native of the Cape of Good Hope. It is a grateful plant, and in almost any soil, with plenty of water, sunshine and but little care will send forth its shrubby, leafy stems and red, pink or white flower clusters from a tin can as readily as from an expensively-prepared bed. In some places, California especially, this ornamental plant grows almost like a little tree. Geraniums are popular for their brilliant flowers and beautifully-marked fragrant foliage. The leaves of the *rose geranium* are especially fragrant and are often used to flavor jellies. The *ivy leaved* geranium, with its trailing habit, shiny leaves and loose flower clusters, is a favorite for window boxes.

[redacted] species of wild geranium popularly known [redacted]ill, is found wild in parts of the , Canada and Europe. It has s and magenta flowers, which do however, when picked. Its root is used in medicine as a stimulant. Th *aria,* common in the Pacific coast region it is used for forage, is a genus of geran

THE GERANIUM
As a house plant.

The geranium is an ideal winter-fl plant for the home, since it adapt readily to conditions found in the ordinary living-room. If plants are obtained which have not been exhausted by blooming during the summer, that is, whose buds have been removed as they appeared, they will with little care blossom in profusion from January to June. The housewife who sees that her geraniums have a sunny location and enough water to keep them constantly moist at the roo indoor garden throughout t

WIL

GERARD, *je rard'*, JAMES WATSON (1867-), an American diplomat who was called upon to represent his country in one of the most critical periods of its history. In 1913 he was appointed ambassador to Germany by President Wilson; the following year saw the great powers of Europe engaged in the War of the Nations, in the course of which the relations between Germany and the United States became repeatedly strained as a result of the German submarine policy. Throughout the period when the two nations were attempting to come to an understanding through diplomatic correspondence Gerard carried on his trying duties with a skill and tactfulness that won admiration. In February, 1917, when President Wilson severed diplomatic relations between the two countries he was recalled.

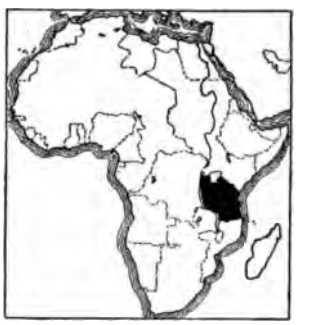
Gerard is a native of Geneseo, N. Y., and a graduate of Columbia University (1900) and Columbia Law School (1902). For three years, from 1908 to 1911, he served as associate justice of the supreme court of New York. He was also active in Democratic politics in his state, having been chairman of the Democratic campaign committee of New York County for several years. In 1914 he was a candidate for United States Senator.

GERIN-LAJOIE, *ger'aN lah zhwa'*, ANTOINE (1824-1882), a Canadian novelist and poet, whose story of *Jean Rivard* is one of the classics of French-Canadian literature. Like many of his contemporary men of letters, Gerin-Lajoie was a barrister by profession, but for many years was either contributor to or editor of several periodicals. He was one of the founders and at one time president of L' Institut Canadien. *Jean Rivard* is his best book, but also noteworthy are *Le Jeune Latour (Young Latour)*, a tragedy, and *Dix Ans d'Histoire du Canada, 1840-1850 (Ten Years of Canadian History)*, a clear analysis of the decade during which responsible government was established in Canada.

GERM, *jurm*, in its broadest sense, the term applied to the earliest stage in the growth of a living organism. For example, the botanist calls the embryo of a seed the germ of the plant, and the sprouting of the seed is known as *germination*. In popular language, the terms *bacteria* and *germs* are used synonymously when reference is made to the minute organism which medical investigators have proved to be producers of disease. See BACTERIA AND BACTERIOLOGY; DISEASE; subhead *Germ Theory of Disease;* subtitle *Diseases of Plants.* W.A.E.

GERMAN EAST AFRICA, the most important and the largest of the German colonies, situated on the east coast of Africa. The conclusion of the War of the Nations may leave this great colony a German possession, though it may be lost to that country. It is one of the healthiest and most fertile regions in equatorial Africa. It cuts in two the vast British possessions stretching along the eastern half of the continent, and prevents a continuous communication through British territory between Cape Town and Cairo.

Area and Population. The area of German East Africa is estimated at 384,000 square miles, or nearly the size of Germany and France together. It is nearly 20,000 square miles larger than the great Canadian province of Ontario. Its population is estimated at about 7,700,000 inhabitants, of whom only 5,500 are whites.



LOCATION MAP

Description and Resources. The coast, which is 620 miles long, is low and flat, but most of the interior is a table-land situated at an altitude of 3,000 to 4,000 feet. South and east of this table-land are several chains of mountains. In the north-eastern corner of the colony rises the volcanic peak of Kilimanjaro, 19,720 feet, which is the highest point in Africa. The rivers are not navigable.

Agriculture and cattle raising form the chief occupation of the inhabitants. Millet, wheat, cotton, tobacco, copra, rice, coffee, tea and sugar cane are grown. Rubber is collected in increasing quantities. These together with ivory constitute the chief exports. Coal, iron, copper and salt have been found.

The capital and chief seaport is Dar-es-Salaam, which is connected with Ujiji on Lake Tanganyika, a distance of 743 miles, by a railway which traverses the colony from east to west. There is another railway running from Tanga on the coast to the foot of Kilimanjaro, a distance of 220 miles.

History. German colonization started here in 1884, and the boundaries of the colony were fixed by treaties concluded with England, Belgium and Portugal in 1890. A serious upris-

ing of the natives that took place in 1905 was soon crushed, but it had the effect of making the German authorities improve their treatment of the natives. During the War of the Nations, begun in 1914, English and French

TYPE OF NATIVE VILLAGE
German East Africa.

troops invaded the colony and fought several engagements with the German forces, but without any decisive result. In the early part of 1916 the English started a strong offensive in order to conquer the colony. O.B.

GERMAN LANGUAGE, one of the great languages of the world, spoken by about 80,000,000 people. Within the German Empire over ninety per cent of the inhabitants use some form of German speech, while in Austria-Hungary and in Switzerland there are millions of German-speaking people. To those unacquainted with it, German is not a musical language, owing to its guttural sounds, and those who are accustomed only to English find it difficult to master German because of its very different sentence order, its inflections and its custom of building compound words by merely joining together simple ones. The very characteristic tendency to place some verb form at or near the close of the sentence Mark Twain described in the words, "The German dives into the Atlantic of his sentence and comes up on the other side with a verb in his mouth." As for the custom of word-building, those who speak other tongues may well be envious, for in German it is possible to express in one adjective an idea for which another language would have to make use of cumbersome phrases and clauses. What other language, for instance, could achieve such a triumph as "the with-great-pleasure-a-large-[illegible]-eating child"?

German is much more nearly phonetic than is English; that is, it has fewer silent letters and fewer variations in the sounds of letters. If a learner has mastered thoroughly the sound-value of every German vowel, consonant and diphthong, he need not fear to pronounce any word he sees, for it is almost certain to be sounded just as it is written. Especially rich in synonyms, German affords opportunity for most exquisite effects in word-choice, and no language better fulfils the demands of the orator and the poet.

Historical. The term *German* includes two branches, the High German and the Low German, but only the former is considered here, the latter having special treatment under the heading PLATTDEUTSCH. The growth of the German language has been a gradual development through three periods, the Old High German (700-1100), Middle High German (1100-1500) and Modern German, from 1500 to the present time. In the earlier periods each section of the country spoke a different dialect and no attempt was made at unifying, but when German became the official language of the imperial court the particular dialect spoken there came to be looked upon as superior to the others. Its use spread in official circles, and by the beginning of the Modern German period this one branch was so much more commonly understood than any other that it was the natural one for Luther to use when he came to translate the Bible. Frequently it is stated that Luther gave to the German language its literary form, but this is not true. It had practically crystallized before his time, but he helped very decidedly to widen the knowledge of it. Every German who wanted to read his Bible had to know the particular dialect in which it was written.

To-day there are numerous dialects in German, as there are in any language spoken by a very large number of people, but the language of books is the same wherever German is used. A.MC C.

GERMAN LITERATURE. As English literature runs back into the old Anglo-Saxon, so German grew gradually out of the medieval Gothic, and at approximately the same period; but distinguished names do not appear in the history of German literature nearly as early as in the English. The three greatest writers England has produced—Shakespeare, Milton and Chaucer—all lived early in her literary history, but Germany had before the beginning of the eighteenth century only one author

of first rank, and that was Martin Luther. Though German literary achievement has thus been crowded into a comparatively brief period, it is worthy to rank with that of any other great nation. No scholars are more profound than those of Germany, and from no other country have so many systems of philosophy been issued; no poets are more exquisitely lyrical than the Germans, and German songs are sung the world over; while in Goethe, Germany has one master who stands with the few dominant literary figures of the world.

Early Period. As in most countries, literature began in Germany with the songs of the minstrels, the *sagas* of great heroes. These were written, or sung, rather, in various dialects and were merely local in their appeal, for Germany was not in those early times a nation, but a group of little, warring states. But a national feeling was being born, and every emperor who did anything to unite the severed states or to increase German power at the expense of some other country was helping to give it life. And with the birth of a national spirit there came into being in the early thirteenth century the great national epic, the *Nibelungenlied* (which see). This was not the product of a single poet or a single time, but was woven of the ballads and folk tales of innumerable minstrels of the centuries that were past. The spirit of the Crusades was abroad, and the love of chivalry was voiced by the German *Minnesingers,* who correspond in a measure to the *troubadours* of France (see MINNESINGER; TROUBADOUR).

In time this first spontaneous outburst of song died away, and poetry became more stilted and artificial. The *Meistersingers* took the place of the *Minnesingers,* and the commercial spirit of the times made itself felt even through the poetry.

The Reformation Period. An upheaval was preparing which should both startle men's minds into keenness and banish artificiality—the great Protestant Reformation. Luther is the commanding figure of this period in its literature as in its history, and his translation of the Bible was the one truly great work handed down by it to later times. Of literature in the sense of easy and graceful tales or serious writing there was practically none; everybody was interested in some phase of the Reformation and cared more to advance his cause than to produce matter that was formally correct. Even the chief poet of the era, the picturesque Meistersinger, Hans Sachs, sounded the aggressive spiritual note in his songs. From the close of the Reformation period to the beginning of the eighteenth century little that was noteworthy was produced. The Thirty Years' War exhausted the country so completely that the people had no heart for literature.

From the Eighteenth Century to the Present. It seems little short of marvelous to turn from such dearth of literary accomplishment to the richness of this later period. As the country recovered from the disastrous effects of the Thirty Years' War a new feeling of nationality began to awaken, and this was intensified by Frederick the Great and his achievements in the Seven Years' War. This powerful ruler gave no special encouragement to German literature, but it grew up about him and actually helped him in his work of building up a real Germany, with Prussia as a center. The technique of poetry improved much in the hands of Klopstock, the first master of the modern German lyric; the new spirit of freedom and expansion found expression in Wieland; German drama rose to fresh heights with the production of Lessing's great plays; and almost every field of German thought felt the influence of Herder.

But the real Golden Age of German letters was yet to come, though it was near at hand; for Goethe and Schiller were born near the middle of the eighteenth century, and with them German literature reached its great height (see GOETHE; SCHILLER). Few nations can present so perfect a type of the universal genius as was Goethe, and his influence is still felt in every literature of Europe. Contemporaneous with the great two, or slightly later, was a group of men distinguished in every field. Kant, Fichte, Schelling, Uhland, Jacob and Wilhelm Grimm—those were but a few of the names that made the era illustrious. As in France, Romanticism had its day, with Jean Paul Richter at the head of the movement, and though its excessive emphasis on idealism and fantastic imagination defeated its own purposes and brought about its decline, it had succeeded in modifying permanently the formal classicism.

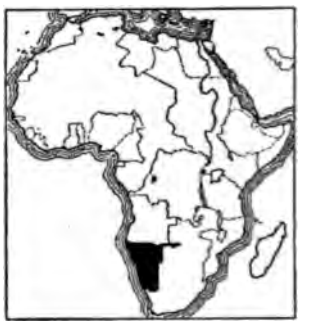
In the period following that of Goethe the most important figure in German literature was Heine, influential in many departments, but supreme in that of lyric poetry. The second quarter of the nineteenth century was a time of political and social unrest in Germany, and much of the literature produced, whether it

was poetry, fiction or drama, had some cause to advance. Since the establishment of the German Empire in 1871 as one of the great powers of Europe, literary development has been steady, and in any list of writers of high rank a number of Germans would have to be mentioned. To enumerate these is impossible here, but any treatment of German literature would be incomplete without the mention of the two great present-day dramatists, Sudermann and Hauptmann. Literature suffered in Germany by reason of the War of the Nations, which engulfed Europe in 1914, as it did in other countries engaged therein, but out of Germany there came the poem which critics agree in calling the one really great expression of the war spirit—Lissauer's *Hymn of Hate*. Its author afterward apologized for its bitter feeling, and the German government disavowed its attitude, but from a literary point of view it stands unequaled by the multitude of other poems called forth by the great struggle.

Each great writer named in this article is referred to at length elsewhere in these volumes. A.MC C.

GERMAN SILVER. Much of the so-called silverware used on the table consists of a yellowish metal that has been coated or plated with silver. When new, this ware has the appearance of solid silver, but the plate wears off by use and the yellow metal is revealed. This metal is an alloy of copper, nickel and zinc, in proportions of two parts copper to one part nickel and one part zinc, and is known on the market as *German silver*, or *nickel silver*. The proportions of copper and nickel vary to adapt the alloy to different purposes. When designed for making casts and candlesticks, a little lead is added. The addition of iron or steel makes the alloy harder, whiter and more brittle. German silver is harder than silver and takes a good polish, but it is easily tarnished. Vinegar and strong solutions containing salt form poisonous compounds with it, and tableware from which the silver has been worn away should not be used with such liquids or with fruit.

GERMAN SOUTHWEST AFRICA, until 1915 a German colony, situated on the southwestern coast of Africa, bordered south and east by the Union of South Africa and Rhodesia, north by Portuguese West Africa and west by the Atlantic Ocean. In the year named, the first year of the War of the Nations, the English conquered the territory and named it SOUTHWEST AFRICA PROTECTORATE. Its fate at the conclusion of the war could not be foretold in 1917, but English statesmen declared it should not be returned to Germany.



LOCATION MAP

Nearly at the middle of its coast line, which is 950 miles long, is the port of Walfish Bay, which with the adjoining territory had always belonged to Great Britain. Its area is estimated at 322,000 square miles, or more than one and one-half times that of the whole of Germany or France. The size of this colony is equal to the combined area of the states of Ohio, Indiana, Illinois, Michigan, Wisconsin and Minnesota. It has only 30,000 square miles less than the great Canadian province of British Columbia. The population is estimated at about 80,000 natives and 15,000 Europeans.

Description and Resources. The coastal zone, extending inland about sixty miles, is sandy and barren, and is bordered by a wide belt of highlands, which rise gradually to an altitude of 3,000 to 6,000 feet. The eastern part of the colony is a sandy desert and forms part of the great Kalahari Desert, which stretches through the northern part of Cape Colony to the borders of the Transvaal and Rhodesia. The capital is Windhoek, situated in the interior and connected by railroad with Swakopmund, on the coast, where a harbor has been built. Another railroad starts at the seaport of Angra Pequena, or Lüderitz Bay, and goes to Kalkfontein, at the border of Cape Colony. This line was linked up with the railways of the Union of South Africa by the building of a railroad from Prieska in Cape Colony to Kalkfontein. This railroad, 314 miles long, was built in connection with and during the military operations undertaken by the British in 1914-1915.

Sheep and cattle raising constitutes the chief source of wealth of the inhabitants. Copper is mined, and since 1908 large quantities of diamonds are extracted in the neighborhood of Lüderitz Bay. Gold and other minerals have also been found. The chief exports consist of wool, hides, horses, ivory, ostrich feathers, copper ore and diamonds.

History. Germany began to take possession of this region in 1884. The boundaries of the colony were fixed by treaty with England and Portugal in 1890. In 1903 a Hottentot tribe revolted, and in the following year the powerful Herero nation rose in rebellion. This revolt was only subdued after three years of very stubborn fighting.

Shortly after the outbreak of the War of the Nations in 1914 British troops under General Louis Botha invaded this German possession. After a campaign characterized alike by boldness of conception and rapidity of execution, Botha conquered one after another the chief points of the colony. On May 12, 1915, he hoisted the British flag over Windhoek, the capital, and on July 9, 1915, the German authorities were finally compelled to surrender the colony to the British. O.B.

GERMANTOWN, BATTLE OF, an important engagement of the Revolutionary War in America, on October 4, 1777, between the Americans under Washington and the British under Howe. Washington opened hostilities at daybreak and was at first successful, but in a dense fog one American column mistook another for the enemy and opened fire upon it. The American troops were thrown into confusion, and a general retreat followed. Washington's courage in attacking the British so soon after the defeat at Brandywine led the hitherto undecided French court to form an alliance with the United States, and this fact gives to Germantown its historic importance.

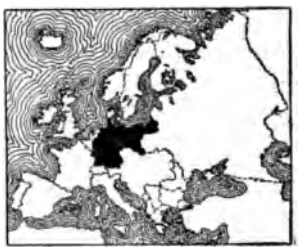
Germantown, the village where the battle was fought, was a former suburb of Philadelphia, but since 1845 has been included within the city limits. It was settled in 1683 by a party of Germans. The first paper mill in America was erected there in 1690, and in the little town in 1743, the first American edition of the Bible was printed. Its picturesque location, fine architecture, and beautiful parks make it a desirable residence place.

GERMANY, or more accurately speaking, the GERMAN EMPIRE, is a state of Central Europe, one of the most important countries of the continent. As a state it is, in its present form, very young—younger even than the United States; but the beginnings of its history go far, far back, and no phase in the life of Europe is more interesting than the tracing of Germany's growth in size, in power and in national consciousness. The name to-day is likely to recall thoughts of the War of the Nations, in which Germany ranged itself, in 1914, with comparatively weak Austria, against a dozen powers, and interest in Germany and its affairs is consequently keener than ever before. The facts which are related in this article must refer in large measure to Germany as it was just before the War of the Nations. From the outbreak of that struggle there was about the country such a wall of steel that practically no reliable information as to internal conditions reached other peoples.

What Germany Comprises. The German Empire is not, like Russia, a unit, with divisions merely for purposes of local government; nor is it, like the United States, a union of commonwealths of equal rank and with equal powers and privileges. It is made up of kingdoms, grand duchies, duchies, principalities and free cities—twenty-six states in all; and the distribution of rights and privileges is a rather complicated matter and can be understood only in connection with the history of the country. For every complexity, no matter how strange it may seem at first sight, has its explanation in some crisis in the growth of the state.

Germany has in some ways a peculiarly favorable location, for it is in close connection with most of the great states of Europe. On the east are Russia and Austria-Hungary; on the south Austria-Hungary and Switzerland; on the west, France, Belgium and Holland; and on the north the North Sea, Denmark and the Baltic Sea. Germany lies between latitudes

47° 16′ and 55° 53′ north, and thus occupies approximately the same north and south position as Newfoundland and Labrador, but other conditions differ so that a traveler would not suspect this similarity.



LOCATION MAP

Interesting Measurements. The total area of Germany is 208,825 square miles—slightly greater than that of the Canadian province of Yukon, or of the combined states of Colorado and Wyoming. Among the states of Europe it is third in size, only Russia and Austria-Hungary surpassing it, though its hereditary enemy, France, almost equals it; while its population in 1911 of 64,925,993 made it second only to Russia among the European countries. It is a very irregular country, with a compact western portion and widely extended easterly provinces, so that its greatest dimension by far is from southwest to northeast. In this direction one may travel in a straight line in Germany more than 800 miles, or farther than from Chicago to Washington, D. C.

About one-third of the whole border line of Germany, or 1,200 miles, is sea coast. See below, the subtitle *Physical Features.*

The People. The Germans, or as they call themselves, *Deutsche,* are Teutons—that is, they belong to that great division of the human race which includes the Scandinavians, the English, the Dutch and most of the inhabitants of Canada and the United States. The typical German has fair hair and blue eyes, and is rather solidly built; but it is estimated that less than one-third of the inhabitants of the Empire are of this type, by far the greater number belonging to an intermediate brown-haired type.

Temperamentally the Germans have certain very distinct characteristics. Perhaps the chief of these is thoroughness. Without the quickness of the French or the bulldog determination of the English, the German accomplishes results by a stolid perseverance which ignores all obstacles. "German stolidity" has become proverbial, but the term stolidity is by no means uncomplimentary, for no people has delved deeper and more effectively into philosophy; no people has wrought out more painstaking and accurate scientific systems, or has produced literature, whether of the realistic or the imaginative type, of more lasting importance.

All the inhabitants of the United States may be called, in a certain sense, Americans; all those of the Dominion, Canadians, but all the inhabitants of the German Empire are not in this same sense Germans. These non-Germans are not immigrants who dwell in the country without becoming a part of it, but are people living on their ancestral soil and who speak the language which their predecessors have spoken for centuries. Thus there are Poles in the provinces of Silesia and Posen; Danes in Schleswig-Holstein; French in Alsace-Lorraine; Czechs in Silesia—in all, a population of over 4,000,000 of non-German blood. These various peoples, on land which did not always belong to Germany, speak their own tongues, but for the most part German prevails. All Germans, however, do not speak exactly the same language or dialect. In the northern, or lowland district, there is the so-called Low German, or *Plattdeutsch,* while in the highlands of the south, High German is spoken. This latter is the language of German literature, and is making its way little by little into the territories which once knew only Plattdeutsch (see GERMAN LANGUAGE; PLATTDEUTSCH).

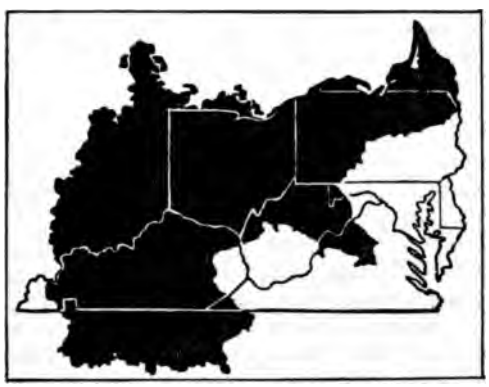
With its total population of 64,925,993 before the War of the Nations, Germany had a density of 310.9 to the square mile—considerably less than England, Belgium or the Netherlands, and about ten times that of the United States as a whole. The distribution of the inhabitants is very uneven, for one kingdom of the Empire, Saxony, has about 800 to the square mile. Considerably more than half of the people live under urban conditions, that is, in communes of more than 2,000 inhabitants. There are twenty-four cities each with a population greater than 200,000, and the total number of those with more than 100,000 is forty-eight. The chief cities, most of which receive detailed description in separate articles in these volumes, are Berlin, the capital; Hamburg, Leipzig, Munich, Dresden, Cologne, Breslau, Frankfort-on-the-Main, Nuremberg, Hanover, Stuttgart and Bremen.

The Germans have a much stronger tendency to emigrate than have the French, for example, and it is estimated that during the nineteenth century no fewer than 6,000,000 people left their ancestral homes. By far the larger number of these chose the United States as their foster-country. H.M.

Physical Features

The Surface. Germany has two sharply-contrasted surface regions—a northern lowland and a central and southern highland, the latter occupying about two-thirds of the country. The lowland is a part of the great plain of Northern Asia and Europe, and stretches from the borders of Russia to those of Holland. For the most part this plain is level, but there are several elevated tracts which attain in places heights of 1,000 feet or more. Sloping to the north and northwest, to the shores of the North and the Baltic seas, this plain ends in the low-lying coastal flats, with sand dunes and infrequent harbors. Only where a river, as the Elbe or the Weser, finds its way to the sea are their channels wide enough and deep enough for good ports.

The highland region is much less uniform; indeed, it may be divided into two well-marked sections. In the southeast is the Alpine country, with its spurs or ridges branching out from Switzerland. Here, in Bavaria, is found the highest altitude in Germany, the Zug



COMPARATIVE AREAS

The area of Germany covers 208,825 square miles. It is but little larger than the American states of Ohio, Kentucky, Virginia, West Virginia, Pennsylvania, Maryland and Delaware, a compact group whose combined area is 208,258 square miles. Compared with the Canadian province of Alberta, Germany is nearly 50,000 square miles smaller.

Spitze, which has an elevation of 9,738 feet. North and west of this limited Alpine district are the highlands proper, a greatly diversified region with high, fertile plains, rolling, hilly sections and numerous scattered mountain ranges with rounded summits, few of which exceed 3,500 feet in height. Of these mountains the most important are the Riesen-Gebirge, or Giant Mountains, the Vosges, the Erzgebirge, or Ore Mountains, so called from the copper, iron, silver and other ores which they contain, the Schwarzwald, or Black Forest, about which center so many traditions, and most famous of all, the Harz Mountains, with their culminating peak, the Brocken, which stands shrouded in mist, fairly inviting the wierd and gloomy legends which cluster about it.

One of the very interesting points in the study of history is the relation which it bears to the geography of a country, and this is strikingly shown in the case of Germany. Had there been no branching mountains, acting as natural barriers and separating the territory into numerous high plains and valleys, inviting century upon century of warfare, separate states might never have been, for with freer intercourse a single nation might have developed far earlier.

Rivers and Lakes. Germany is rich in rivers, having within its borders about 6,000 miles of navigable natural waterways. The central highland region acts as a "great divide," separating the rivers that flow into the North and Baltic seas from those that flow into the Black Sea. Of the latter there is but one of importance, the great Danube, which rises in the Black Forest and drains the greater part of Bavaria. The chief rivers which empty into the North Sea are the Rhine, the most important river of the empire, though it has neither its source nor its mouth within Germany; the Ems; the Weser, with its great port of Bremen; and the Elbe, on which is situated Hamburg, the chief port of the country; while those flowing into the Baltic are the Oder, which, like the Weser, is entirely in German territory; and the Vistula, which is chiefly a Russian river and carries down to the sea not only the drainage, but a large portion of the commerce of Russia. Certain tributaries of these larger rivers, as the Main, the Moselle and the Saale, are also of considerable importance.

One of the lake regions of Germany is in the Alpine district in the southeast, where the glaciers of bygone ages carved deep basins in the rocks. These mountain lakes have the clear, cold water and the same picturesque surroundings which have made the Swiss lakes the most famous in the world. Scattered about the northern plain are numerous shallow lakes—no fewer than 500 in all; but these, with their low, swampy shores, have no particular beauty

or importance. The rivers which flow into the Baltic empty into curious land-locked bays, called *haffs,* very shallow and ringed with sand dunes. The largest of these, the Kurisches Haff, into which the Memel empties, has an area of 626 square miles.

Climate and Life Forms. Though Germany extends through almost nine degrees of latitude there is comparatively little variation in temperature between the north and the south, because the high altitude makes the south cooler than it might otherwise be, while the sea breezes have just the opposite effect on the northern portion. Thus in the south the average annual temperature is about 52°, while in the north it is about 48°. The variation east and west is more marked, the inland region to the east having a distinctly continental climate, with extremes of heat and cold, while in the west the summers are not so hot nor the winters so cold. The rivers flowing into the Baltic are obstructed by ice for considerable periods each winter, but those flowing to the North Sea are seldom frozen over, except the Elbe, the easternmost of the North Sea rivers.

As to rainfall, there is almost everywhere enough for agriculture, but the distribution is very uneven. It is heaviest in the Harz Mountains, which average over forty inches each year and in some parts have no less than sixty inches; but most of the mountain and western coast regions have from twenty-five to thirty inches.

In the very olden days Germany was a heavily forested country, and many of the old myths and superstitions are connected with trees. Germany has not been as wasteful of its forests as some other countries, for to-day about one-fourth of the entire surface is wooded, and forestry is well advanced. That this is true even the children may know, from the frequent allusions to foresters in their fairy tales. So thickly overgrown are some of the mountain ranges that they are called not *mountains* but *woods,* as Schwarzwald, or Teutoburg Forest. About two-thirds of the trees are cone-bearers—pines and firs; and the rest are chiefly oaks, beeches and birches.

The animal life is in some ways very interesting, for in the Southern Alps and in the Harz Mountains are to be found foxes and wildcats, while wild boars and deer still roam many of the dense forests. Birds are numerous, but most of them are but transients, for two of the great migration routes cross the Empire (see BIRD, subtitle *Migration of Birds*). H.M.

Resources and Industries

Mineral Wealth. Germany is one of the richest in minerals of all the European countries, and its chief products are those two basic minerals, coal and iron. Only the United States and Great Britain among the countries of the world produce more coal and only the United States more iron. Westphalia, Silesia and the Rhine Province yield most of the coal, about ninety per cent of the annual output of 190,000,000 tons, in normal times. This is exclusive of lignite, of which more than one-third of the above amount is produced. As yet no limit can be seen to the coal stores of Germany, though some of the richest mines have been worked for five or six centuries.

The production of iron increased rapidly during the late nineteenth and the early twentieth century, the output of pig iron amounting in recent years to almost 20,000,000 tons annually. In its yield of silver, too, Germany ranks first among the European countries, and copper, [illegible] nickel are mined in considerable [illegible]ere are vast deposits of salt and [illegible]ash compounds, and to these [illegible] large measure the growth in the chemical industries. All along the Baltic coast amber of excellent quality has been obtained for fully two thousand years.

"Made in Germany." Without its mineral wealth Germany could not have had in recent years its marvelous industrial development—a development greater than that of any other country within the same period. In the value of its manufactures it has passed France, long its rival, and in 1913 was surpassed only by Great Britain and the United States. The "Made in Germany" legend stamped on goods of various sorts has become familiar in all parts of the world, and on almost all wares is a guarantee of quality. The oldest and most important of the industries are the textile manufactures, whether cotton, linen, woolen or silk. Much of the raw cotton and wool is imported, but the high valleys of Silesia, Saxony, Westphalia, the Harz and other districts are in the season blue with the spreading fields of flax. Dress goods, clothing, damasks, carpets, thread laces and shawls are produced in great quantities, and most of the manufactures are rather sharply localized.

The metal industries in all their branches of steel and iron rolling, the making of machinery and the manufacture of hardware and instruments have experienced the largest growth. The products of the great Krupp gun works, which employ scores of thousands of workers, are too famous, especially since 1914, to need mention, but in many kinds of smaller metal goods, as cutlery, tools and instruments, the Germans have long enjoyed an equal superiority. Their scientific instruments, in particular, are considered the most accurate in the world. Beet sugar, of which more is produced than in any other country; beer, of which an average of twenty-two gallons to each person is consumed annually in the empire; chemicals; great ships; toys, clocks and carved woodenware—in the making of all of these Germany excels. The statement made at the opening of this article may be emphasized here: all these facts refer to Germany before the outbreak of the great war in 1914, for every phase of its life has been immeasurably changed since then.

An interesting feature of the industrial life of Germany is the compulsory insurance by which workers are made safe against loss of income through sickness, old age or accident. Part of the fee—a very small part—is paid by the person insured; the remainder is shared between the employer and the government. Since almost one-half of the population derive their living from the manufacturing industries, it may be seen that this is a provision of great importance.

Agriculture. Time was when Germany raised practically all the foodstuffs it needed, but in recent years, since many have turned to industrial life and less than a third of the population is engaged in agriculture, much food must be imported. About one-half the entire land surface is actually under tillage, and of this area a large part is divided into very small farms, millions of these being less than five acres in extent. But the German farmer is painstaking and intelligent, and by the use of modern methods and machinery he wrests from the soil, in some places none too fertile, a fair living. The least fertile portions of the country are in the north and northeast.

Crops are widely varied, but in the empire as a whole cereals, potatoes and hay predominate. Of the cereals, rye is the most important, and rye bread is as distinctly the staple food of the poorer people of Germany as is wheat bread in Canada and the United States. Over a million acres are under sugar beets, which form the prevailing crop of North Germany, while in the south and west, especially in the valleys of the Rhine, Main, Moselle and Neckar, the vine is the most characteristic growth, Rhine wines being famous throughout the world. Flax in the central region, hops, corn and fruits in the south, and almost everywhere wheat, barley, rye and oats—these are the outstanding crops. The government has done much to encourage agriculture, and a spirit of intelligent coöperation among the farmers themselves has worked for progress.

Stock raising is of considerable importance, for Germany has much partially drained marsh land with a rich growth of grass. Of the domestic animals swine are the most numerous and cattle the next, the number of sheep in the empire having declined three-fourths within the last three decades. The government interests itself in the raising of good breeds of horses.

Transportation and Commerce. With its 6,000 miles of naturally navigable rivers, 1,400 miles of canalized rivers, and 1,500 miles of canals, Germany has an abundance of waterways. Some of the canals are famous, notably the Kaiser Wilhelm Canal across the peninsula of Jutland, which connects the Baltic with the North Sea. See KAISER WILHELM CANAL. The empire is not dependent for transportation upon waterways alone, for it has one of the largest and most complete railway systems in the world. Only Russia and the United States, far vaster in extent, exceed Germany's total of more than 39,000 miles, and only Great Britain surpasses it in the length of railway compared with its area. Berlin is the chief railway center. Over ninety-two per cent of the railway mileage is in the hands of the state governments, each state controlling the lines which have the greater part of their course within it.

Commerce. No other country except Great Britain had so large a foreign trade as had Germany up to August, 1914. The remarkable industrial development brought about a corresponding commercial growth, and in recent years the total foreign commerce has been about $4,600,000,000. Of this amount the imports make up somewhat more than half, and in this Germany differs from the United States, which exports more than it receives. Fully one-half of the imports are raw materials for its factories, and one-third consist in foodstuffs, while the exports are largely manufactured goods—textiles, metal products, chemi-

cals, certain made foods, toys and small wares. The United States, Great Britain, Russia and Austria-Hungary have been for years the countries with which Germany has carried on the largest trade, Russia ranking first in the amount imported into Germany, and England being the largest receiver of exports. The growth of the trade with the United States has been a significant feature of the past two decades. Cotton, copper, lard and wheat are the most important articles supplied by the United States to Germany, but Russia supplies the larger part of the wheat. What the condition will be for years after the war it is impossible to forecast.

There has been no customs union since 1871, as the customs rights of the state went over to the empire. H.M.

Social and Political Conditions

Education. The very first rank in educational matters is generally conceded to Germany, whether reference be had to the development of the highest arts and sciences, or to the general spread of ordinary education. Different indeed would be the history of education if the names of German educators were omitted. There are practically no illiterates in Germany, only two out of ten thousand of the military and naval recruits being unable to read and write. The compulsory education law, which provides that every child between the ages of six and fourteen must attend school throughout the whole school year, is rigidly enforced.

This entire compulsory period may be spent in the "folk schools" as they are called, and these are free. Children who intend to go beyond these primary schools, however, do not take the whole eight-year course in them, but are transferred, after they have learned the rudiments, to higher schools; while those who continue in the folk schools rarely go to any other unless it be the "continuation schools" which fit them for trades.

Many of the secondary schools have special preparatory schools in connection with them, and in these, as in the secondary schools themselves, fees are charged. The most famous type of these secondary schools is the *gymnasium,* a school which places chief emphasis on the classics. There are also the more modern *realschule,* which stresses mathematics, science and the modern languages, but includes Latin; and the *oberrealschule,* which rules out the classics altogether; and in recent years there has grown up a combination type which has the advantage of making it unnecessary, as heretofore, to settle upon a boy's career when he is but nine years old. These schools are for boys only, since until recent years the state has paid little attention to the higher education of girls, leaving that to private institutions. To-day, however, there are three kinds of girls' schools which correspond to the three types described above.

Of universities Germany has no fewer than twenty-one, some of them among the most famous in the world—great schools to which students flock from all over the world to obtain those degrees which always bestow more prestige than degrees gained elsewhere. The largest universities are those of Berlin, Munich and Leipzig, but those of Bonn, Göttingen, Freiburg, Halle, Heidelberg, Würzburg and Jena are no less celebrated.

Germany has been a pioneer in the establishment of vocational schools, especially of those which are but part-time schools, open to young people who must spend the greater part of their time at work. There are also commercial schools and famous technical schools where a man may learn to be an engineer, a forester, a worker in metals, a shipbuilder, an architect—almost anything, in fact, toward which he feels a particular inclination.

The school systems are under state and not imperial control, each state acting independently and making up out of its treasury about half the necessary funds, the rest being supplied by local taxation.

Religion. There is no imperial religion, and in general it may be said that freedom of worship prevails, though certain of the states have what are in effect state religions. In this country, which was the birthplace of the Reformation, the Protestant or Evangelical faith predominates, claiming about sixty-one per cent of the population, while the Catholics have but thirty-six. There is a rather sharp territorial division, some states being largely Evangelical, some Catholic; the distribution, interestingly enough, is very similar to what it was in the earliest days of Protestantism, four centuries ago.

There are within the empire over 600,000 Jews, and in some states their religion receives state support, as do the Christian faiths.

IN GERMANY'S CAPITAL. The famous Brandenburg Gate and its approach. This is the only city gate remaining after the destruction of the old city walls which date from 1789. The central drive is reserved by common consent for the royal family.

Government

a rather complicated matter, but its ures may be sketched very simply. y-six states which make up the em- is follows: four kingdoms—Prussia, axony and Württemberg; six grand aden, Hesse, Mecklenburg-Schwerin, rg-Strelitz, Oldenburg and Saxe- five duchies—Anhalt, Brunswick, burg, Saxe-Coburg-Gotha and Saxe- ; seven principalities — Waldeck, hwarzburg-Rudolstadt, Schwarzburg- sen, Reuss-Schleiz, Reuss-Greiz and rg-Lippe; three free cities—Ham- eck and Bremen; and one imperial Alsace-Lorraine, taken from France se of the Franco-German War in this great federation of states, which d under the constitution dating from 1871, the king of Prussia has the rman emperor. Some of the states, the early paragraphs of this article, al privileges; Prussia, as the strong- assumed the rights it desired, and ers, as Bavaria and Baden, exacted re they would consent to enter the All, however, entered voluntarily.

peror. As king of Prussia the em- certain duties and responsibilities, are distinct from those which he as- n he became German emperor. He opens and closes the federal legis- es, but has no veto power over their ppoints and dismisses all the officers perial service, including the chan- resents the empire in international commander-in-chief of the army and may on his own initiative declare war; but in order to engage in of- r he must have the approval of the uncil (see below). As the chief officer he deals not with the states , but with their sovereigns, for the ute practically all the imperial laws n expense.

ncellor. Since the emperor may not sponsible for what he does, practi- is official acts must be signed by a nown as the imperial chancellor, who ed and dismissed at the will of the This officer is also prime minister . He is president of the *Bundesrat*, l Council, and has a seat in the or lower house, but he is responsible, ther branch of the legislature, but solely to the emperor; for the government of the empire is not parliamentary in the same sense as that of Great Britain. Therefore the chancellor does not resign if his measures are defeated, as does the prime minister of England, but may request the emperor to dissolve the Reichstag and order a new election. Under the emperor he has charge of the execution of the laws of the empire, and he has as his assistants and subordinates thirteen secretaries, each of whom is at the head of a department of government.

The Legislature. There are two legislative bodies, the Federal Council, or *Bundesrat*, and the *Reichstag*, or Parliament, the former representing the different states, the latter the empire as a whole. In fact, the Council is but a body of ambassadors, sixty-one in number, sent by the individual states and voting exactly as they have been instructed by their governments. Any vote cast without such instructions, or contrary to them, is not counted.

THE GERMAN CROWN PRINCE
Frederick William, eldest son of Emperor William II.
(For portrait of Emperor William, see WILLIAM II.)

The really representative branch of the legislature is the Reichstag, which is made up of 397 members, chosen for a term of five years by the vote of all male citizens twenty-five years of age or over. About three-fifths of the members are from Prussia, which has

also leading influence in the Federal Council. Both bodies must be summoned by the emperor once a year. Practically all important measures originate in the Council, but they must have the approval of the Reichstag before they become laws.

The Judiciary. For this, little or no provision is contained in the constitution of the empire, practically all of the courts being established by statute, except the Federal Council referred to above, which settles disputes between states. The present system of courts was created in 1877; it includes district courts, in which petty cases are tried; territorial courts, which hear more serious civil and criminal cases and act as courts of appeal for the district courts; superior courts, which try only cases appealed from the territorial courts; and an imperial tribunal, which stands at the head of the system. This great court, which is located at Leipzig, has over ninety judges, who are appointed for life by the emperor upon nomination by the Federal Council. It is the court of final appeal, but has original jurisdiction in cases of high treason.

Local Affairs. With these the imperial government has little to do, as they are chiefly administered by the states. All the states contribute toward the support of the federal government, but much of what they pay comes back to them as their share of the excise and customs revenues. If there is any conflict between imperial and state laws, it is the latter which must be amended.

Colonies. Germany's colonial policy dates from 1884, and was inaugurated by Bismarck. At the opening of the War of the Nations in 1914 the total area of German colonies was 1,140,115 square miles, distributed as follows:

COLONIES	AREA
Togoland	33,668
Kamerun	305,019
German Southwest Africa	322,432
German East Africa	384,170
New Guinea	92,664
Caroline Islands	956
Samoa	993
Kiao-chau	213
Total	1,140,115

Before the beginning of 1916 there had been lost of the above German Southwest Africa, German East Africa, the Caroline Islands and Kiao-chau. For the colonies remaining the imperial government at Berlin makes all the laws and provides all the officers. H.M.

History of Germany

Its Beginnings. Almost more than that of any other nation, the history of Germany has been one of wars. At almost any point where the student takes it up, the clash of arms may be heard, for the German nation, as a nation, has been long in the making and every step has been gained by conquest. It was as a fearless, warlike people that the Romans first knew these dwellers on their northern borders, and the first definite fact in their history was their defeat of the Roman consul Papirius in 113 B.C. Eleven years later the great general Marius administered in turn a defeat to these Teutones, as they were called, for the term *Germans* was a later name, probably formed by the Romans from some Gallic word.

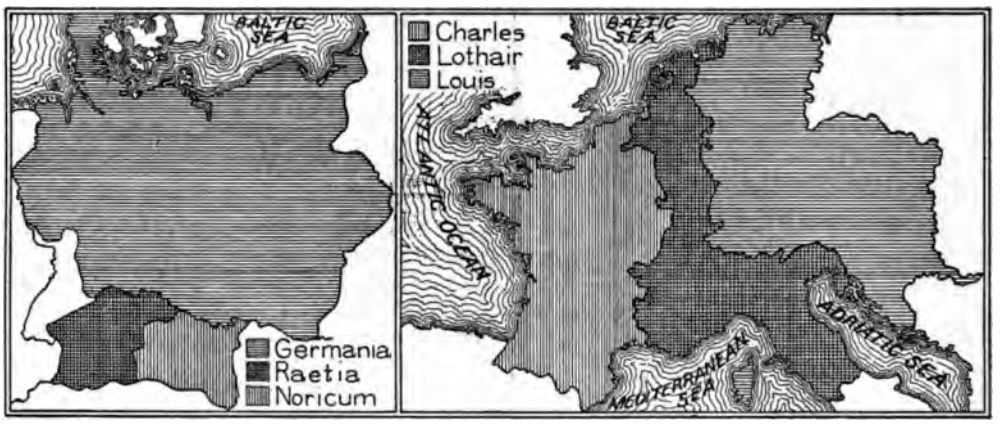
It was Julius Caesar who during his campaigns in Gaul gave to the Roman world the first definite information about some of the barbaric tribes beyond the Rhine—those tall, fair-haired strangers who feared not even the Roman legions. Nominally, Caesar brought Germany under Roman sway, and in the days of Augustus an attempt was made to convert this nominal subjugation into a real one by introducing Roman customs. The effect was disastrous, however, because in A.D. 9 the Germans under Arminius won a complete victory over the Roman legions in a battle which ranks among the decisive ones of the world, for it made it certain that Germany should be Teutonic and not Latin (see FIFTEEN DECISIVE BATTLES). Later expeditions were dispatched to the country, but the Romans never again gained a hold on it, while they, on the other hand, were forced constantly to defend themselves against the invasions of various German tribes—the Alemanni, the Franks, the Goths, Vandals and Lombards.

A Troubled Time. For centuries nothing is known of the internal history of these warring, shifting tribes, which were in no sense a nation. When France, under Clovis, became a state, more and more of the German tribes became assimilated therewith, and in this period the history of Germany is identical with that of France (see FRANCE, subhead *History*). Charlemagne's great empire included Germany as far to the north and east as the Elbe, and was in fact more German than French. In 843,

with the Treaty of Verdun, which assigned to Charlemagne's grandson Louis the eastern part of the empire, the separate existence of Germany really began. From that date France and Germany, in their earlier stages united, have grown farther and farther apart, and rarely has there been a time when perfect friendliness has existed between them.

The newly-established German state had to fight for its very existence, first with the Moravians who set up a strong kingdom in the territory which still bears their name, then with the invading Magyars, or Hungarians. These Magyars, who had swept westward from Northern Asia, Arnulf, the German king, had him as the kingly judge in Wagner's *Lohengrin*.

Otto I therefore succeeded in 936 to a fairly united state, which he proved strong enough to hold together. He defeated the Hungarians so decisively that they never again attempted to invade the west, still further restricted the power of the nobles, and conquered Lombardy, placing on his head the famous Iron Crown of the Lombards (see CROWN, subhead *Iron Crown*), and receiving at the hands of the Pope the imperial title of Holy Roman Emperor. So came into existence that curious anomaly, the Holy Roman Empire, which endured until 1806. Many of the kings who followed Otto, possessing his ambition without his ability,



BEGINNINGS OF GERMANY

At left: Germany at the beginning of the Christian Era, showing the provinces of Raetia and Noricum added to the Roman Empire during the reign of Augustus, and the frontiers along the Rhine and Danube, by which the empire was bounded after A. D. 9.

At right: Empire of Charlemagne, as divided in 843. The Holy Roman Empire under Charlemagne was apportioned after his son's death among his three grandsons, Louis the German, Lothair and Charles the Bald, by the Treaty of Verdun.

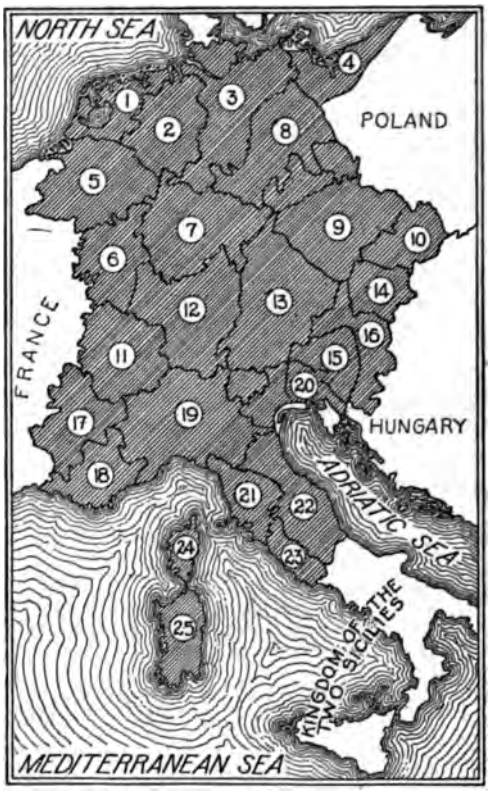
invited to aid him in his struggle with the Moravians, only to find in them a far more dangerous enemy. The reigns of Louis the Child (899-911) and of Conrad were largely taken up with vain attempts to stay the pillaging, slaughtering Magyar hordes.

King and Nobles. Though it had one king, Germany was not at that time a single state, but a number of duchies, whose rulers possessed great privileges. They elected the king, and his power depended very largely upon whether or not he retained their good will. When Conrad died in 918, the strongest of these nobles, Henry the Fowler of Saxony was chosen king, and under him much was accomplished. He defeated the Magyars and the Slavs, reduced the power of the great nobles—indeed, did a work which entitles him to rank as the real creator of the German Empire. Every lover of music is familiar with

strained all their powers to make conquests in Italy, and for the sake of this foreign field neglected Germany itself. The nobles were prompt to take advantage of this state of affairs, drawing more and more power into their hands. However, in 1024 a strong king, Conrad II, came to the throne, and for a time asserted the royal rights. He also conquered Burgundy for Germany and reduced the Polish kingdom, which had grown to a dangerous strength on the eastern frontier, to the rank of a vassal dukedom.

Conflict with the Papacy. Henry III, Conrad's son, who came to the throne in 1039, was a worthy successor of his father, and the great nobles ceased their aggressions for the time. But another conflict was beginning—a conflict which colors much of the history of medieval Germany; for the Pope, whose privilege it was to crown the Holy Roman emperors, felt

that thereby he gained the right to interfere in imperial affairs, while the emperors, as they became stronger, resented such interference. It so happened that a strong Pope, Gregory VII, and a weak emperor, Henry IV (1056-1106), were ruling at the same time, and Greg-



UNDER FREDERICK I, BARBAROSSA

1—Holland	14—Austria
2—Westphalia	15—Carinthia
3—Saxony	16—Styria
4—Pomerania	17—Arles
5—Brabant	18—Provence
6—Lorraine	19—Lombardy
7—Franconia	20—Aquilia
8—Brandenburg	21—Tuscany
9—Bohemia	22—Ancona
10—Moravia	23—Patrimony of Saint Peter
11—Burgundy	24—Corsica
12—Wabia	25—Sardinia
13—Bavaria	

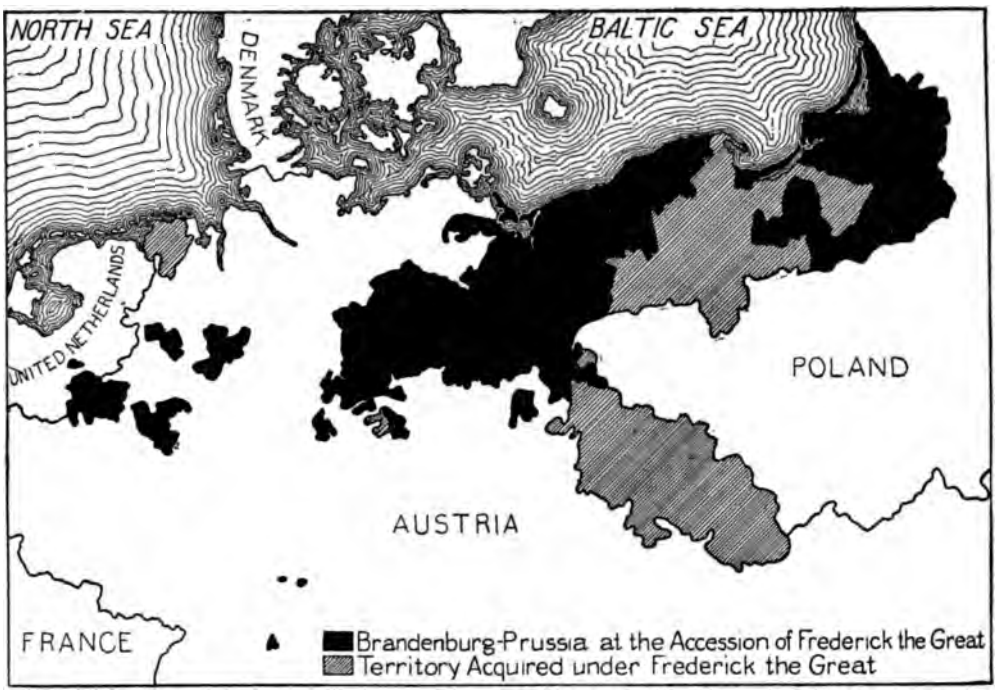
ory was able to rob Henry of some of his prerogatives and to force him to do penance in the guise of a beggar (see HENRY IV, Germany). Under Henry V (1106-1125) and Lothair (1125-1137) the imperial power dimin- came in reality but a shadow.

s Hohenstaufens. In 1138 there mperial throne a new dynasty, the s, the early part of whose ruling he most glorious in the history of Germany. These emperors had a definite purpose—they were determined to make good Germany's hold on Italy, and to wrest from the Pope his temporal powers. Religion was a dominating force through all this time, for this was the period of the Crusades (which see). Frederick I, the beloved Frederick Barbarossa (1152-1190) about whose name legends still hover, was the greatest of the Hohenstaufen emperors, and had he not met his death while on a Crusade he might have strengthened permanently the imperial power. As it was, his successors were for the most part men of little ability, and in the end their powers were so encroached upon by the Papacy and by the great nobles that when the dynasty came to an end in 1254 the titles of German king and Holy Roman emperor were but empty honors.

During this period significant changes had taken place in Germany. Manners and customs had become more refined; women had begun to be looked upon with more respect; the songs and tales of the Minnesingers (which see) had acquired wide popularity; magnificent cathedrals had risen under the influence of the religious enthusiasm generated by the Crusades, and the cities had acquired a degree of freedom and of prominence unknown before.

Another Rise and Fall. For about twenty years after the death of the last Hohenstaufen, anarchy prevailed in Germany. The electors offered the crown to the highest bidder, but of all the rival rulers none acquired any real power. Finally, in 1273, the electors picked out a man whom they thought weak enough not to interfere with their sovereign rights—Rudolph of Hapsburg; and thus that celebrated family came to the throne of Germany. Rudolph proved more vigorous than the electors had hoped, restoring at least a semblance of order and strengthening the royal authority. He showed that favor to his own family for which the Hapsburgs have been noted, and by granting to his son as a dukedom certain territories that he had acquired in war, of which the chief was Austria, he laid the foundation of the state of Austria with its long line of Hapsburg rulers.

For over a hundred years there followed another of those troubled periods, when the royal power was held first by one family, then by another. Significant events which stand out are the successful revolt of the Swiss against Austria; the proclamation by Charles IV (1348-1378) of the Golden Bull (which see), which defined the powers of the electors:

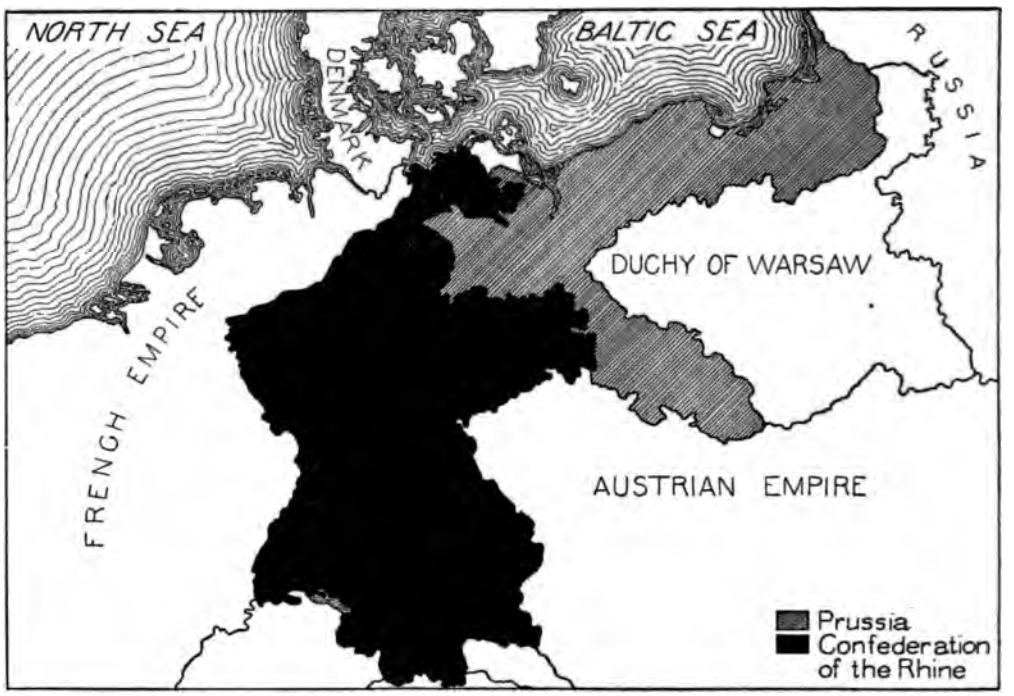


GROWTH OF PRUSSIA UNDER FREDERICK THE GREAT

and the war with the Hussites brought on by the failure of Sigismund (1410-1437) to protect John Huss as he had promised. In 1438 Albert II of Austria, the descendant of that early Albert to whom was granted the domain of Austria, was made emperor, and for almost four centuries the Hapsburgs bore the imperial title, though each time the electors went through the form of choosing. A strong man came to the throne late in the fifteenth century—Maximilian I (1493-1519); and under him the Empire became again in a sense an entity.

Even more powerful was his grandson, Charles V (1519-1556), who during much of his long reign was the dominant prince of Europe, for not only Germany, but Spain, Naples and the Netherlands were under his sway. But even during his reign, when the imperial power was at its very height, the breaking up of the empire was beginning. Luther had nailed to the church door his ninety-five theses, and therewith the Reformation had begun. (For the history of this period see LUTHER, MARTIN; REFORMATION; CHARLES V.) The conflict between Catholics and Protestants was brought to an end temporarily in 1555 by the Peace of Augsburg, which allowed to the Lutherans a certain measure of religious freedom; but this very agreement opened up new questions which were the cause of later dissension.

The Thirty Years' War. The reigns of Charles's successors, Ferdinand (1556-1564), Maximilian II (1564-1576) and Rudolph II (1576-1612), saw the growth of that important movement known as the Counter-Reformation (which see), and an ever-widening gulf between the Catholics and Protestants. In 1617, during the reign of Emperor Matthias (1612-1619), the ardent Catholic Ferdinand was crowned king of Protestant Bohemia, and the result was that gigantic struggle known as the Thirty Years' War. Conditions in Germany during the war were almost indescribable, and at its close in 1648 the country was completely exhausted. Most of the population of the country districts had been killed, enormous debts had been incurred, and many of the industries had been ruined. Moreover, most of the princes had gained, as the price of their aid in the war, practical independence, and instead of one Germany there were about two hundred small states, each of which was only nominally subject to the emperor. The imperial authority was completely wrecked, and national feeling was dead, except in so far as most of the states had come to look upon themselves as in some way opposed to Austria.



GERMANY AT THE HEIGHT OF NAPOLEON'S POWER
The French extended their empire eastward to the Baltic Sea, and included Magdeburg. At this time Westphalia was a kingdom ruled by Napoleon's brother, Jerome.

Germany to the Time of Napoleon. Meanwhile one of the states of Germany was gradually acquiring an increased power. This was Prussia, and it is in the rise of this power that the interest in German history centers for a century and a half after the close of the Thirty Years' War (see PRUSSIA, subhead *History*). In theory the ruler of Prussia, who in 1701 took the title of king, still owed allegiance to the emperor, but in reality there was growing up a determined antagonism between them. A crisis occurred in imperial affairs in 1740, when with the death of Emperor Charles VI (1711-1740) the male Hapsburg line died out, and in accordance with the Pragmatic Sanction (which see) his daughter Maria Theresa attempted to assume the imperial title (see AUSTRIA-HUNGARY, subhead *History*; MARIA THERESA; SUCCESSION WARS, subtitle *War of the Austrian Succession*). Soon after the close of the War of the Austrian Succession another war broke out, between Maria Theresa and the ambitious king of Prussia, Frederick the Great (which see). By his conduct of the Seven Years' War (which see), Frederick brought Prussia still farther to the fore as the natural enemy of Austria and as the one possible center for a future united Germany.

The great European upheaval which followed upon the French Revolution affected Germany profoundly (see NAPOLEON I), ending even the nominal existence of the empire, for in 1806 Francis II formally resigned the title of Holy Roman emperor and took that of Emperor of Austria. It was Napoleon's idea to isolate Austria and Prussia and to form of the west German states a Confederation of the Rhine, but after his fall the Congress of Vienna formed all the German states into a confederacy, with Austria at its head.

Rivalry of Austria and Prussia. The plans for the confederation included the promise of constitutions for the different states, but this provision was in the main ignored, and there were constant disturbances, owing to the demands of the people for constitutional government. It was in 1830 and 1848, those years when the revolutionary spirit was felt throughout all Europe, that these disturbances culminated, many of them successfully. In 1830 was formed the customs union or Zollverein (which see) among the states, and this fostered the growing feeling of nationality which in 1848 resulted in the assembling of a national parliament at Frankfort. But Austria and Prussia, by their rivalry, brought to naught the

federation plans, and the Prussian king, Frederick William IV, refused to accept the title of emperor of the Germans.

In the year 1861 a new king, William I, came to the throne of Prussia, and he was a man of bolder spirit. He called to his aid Bismarck, chief among the nation-builders of modern Europe, and under the direction of that determined minister the unification of Germany proceeded apace. Bismarck's deliberate plans for breaking with Austria are described in the article under his name and in that on the Seven Weeks' War. Emerging from this struggle with new prestige, Prussia gathered about her the neighboring states in a North German Confederation, of which the king of Prussia was president; but even then the ambition of Bismarck was not satisfied.

The Birth of a Nation. He saw ahead a war with France, and prepared for it carefully, so when the latter nation, jealous of the growing power of the Hohenzollerns, forced the issue, the victory of Germany was sure (see FRANCO-GERMAN WAR). France paid a large indemnity and gave back to Germany Alsace and Lorraine, those much prized territories which had belonged to Germany through a thousand years but which Louis XIV had conquered for France. More important to Germany than any territorial gain was the awakening of an intense national feeling among the states, which made it possible to change the confederation into an empire and to proclaim William I as German emperor. This was done on January 18, 1871, and the state was launched on its new career. Bismarck kept the helm during the lifetime of William I and during the short reign of his son, Frederick III, who succeeded in 1888 and died in the same year; and the colonial power of Germany, the formation in 1883 of the Triple Alliance, including Germany, Austria and Italy, and the anti-Socialist agitation were all his work.

The Reign of William II. But the Iron Chancellor, as Bismarck was called, did not find favor with the aggressive William II, who came to the throne in 1888 and showed at once his determination to be the real ruler of Germany, so far as the constitution would permit. Bismarck therefore resigned in 1890, and the list of his successors includes Caprivi, Hohenlohe, Von Bülow and Von Bethmann-Hollweg, who became chancellor in 1909. Germany took an active part in Eastern affairs in 1898 when, after the murder of two German missionaries in China, the port of Kiao-chau in Shantung was seized and made the center of a German protectorate in that region (see KIAO-CHAU). Two years later German troops were prominent in the suppression of the Boxer Rebellion (which see).

Germany and the War of the Nations. In the summer of 1914 there began in Europe that greatest struggle of all times, known as the War of the Nations. The causes, both ulterior and immediate, and the events of the war are treated in the article under that head.

Germany claimed itself not the primary aggressor in the war. From the first, public interest centered chiefly in Germany and England, between which powers the struggle was most intense. Germany constantly asserted that Great Britain was its most malignant enemy, due largely to the fact that the latter's navy was effecting a close blockade of the German Empire. So serious did the blockade become that Germany, through a submarine campaign against friend and foe alike, sought to stop all commerce to its enemies and reduce them, also, to the starvation point. Vessels of all nations were torpedoed on sight and without warning, and this direct violation of international law so alarmed the great neutral nations that on April 6, 1917, the United States declared that through Germany's acts a state of war existed between those two countries. Latin-American countries lined up in sympathy with the American republic, and before May 1 it appeared that the Teutonic empires would have to contend against the greater part of the world. A leading German official voiced the growing conviction that if victory were not achieved by German arms the Hohenzollern dynasty was doomed. See WAR OF THE NATIONS. H.M.

Consult Dawson's *German Life in Town and Country;* Wade's *Our Little German Cousin;* Henderson's *Short History of Germany;* Yonge's *Young Folks History of Germany.*

Related Subjects. The articles in these volumes referring to Germany are numerous, but the following classified index will make reference to them easy.

CITIES AND TOWNS

Aix-la-Chapelle	Breslau
Altona	Brunswick
Augsburg	Cassel
Baden	Charlottenburg
Barmen	Chemnitz
Bayreuth	Cologne
Berlin	Danzig
Bingen	Darmstadt
Blenheim	Dortmund
Bonn	Dresden
Bremen	Duisburg
Bremerhaven	Düsseldorf

OUTLINE AND QUESTIONS ON GERMANY

Outline

I. Location and Size

(1) Centrally located in Europe
(2) Latitude, 47° 16′ to 55° 53′ north
(3) Longitude, 5° 52′ to 22° 52′ east
(4) Geographic relation to other countries
(5) Effects of location
(6) Size

II. What Constitutes Germany

(1) Kingdoms
(2) Grand duchies
(3) Duchies
(4) Principalities
(5) Free cities

III. Physical Features

(1) Sea coast
  (a) About one-third of total boundary
(2) Highland and lowland
  (a) Northern lowland
    1. Part of great plain
    2. Fairly monotonous surface
  (b) Southern highland region
    1. Alpine country
    2. The highland proper
(3) Effect of surface features on history
(4) Rivers
  (a) 6,000 miles of navigable waterways
  (b) Chief rivers
(5) Lake regions

IV. Climate

(1) Comparatively even climate
  (a) Effect of mountains and sea
(2) Greater variation east and west than north and south
(3) Rainfall

V. The People

(1) National characteristics
(2) Diversified character of people
(3) Languages
(4) Population
(5) Density compared with that of other countries
(6) Cities

VI. Industries

(1) Mining
  (a) Great mineral wealth
  (b) Chief products
    1. Coal
    2. Iron
(2) Manufacturing
  (a) Marvelous recent development
  (b) Surpassed only by Great Britain and United States
  (c) Chief products
    1. Textiles
    2. Metal goods
    3. Beet sugar
    4. Beer
  (d) Industrial insurance
(3) Agriculture
  (a) Necessity for importation of foodstuffs
  (b) Methods employed
  (c) Chief crops
    1. Cereals
    2. Potatoes
    3. Hay
  (d) Stock raising

VII. Transportation and Commerce

(1) Railroads
(2) Rivers
(3) Canals
(4) Large foreign commerce

VIII. Education and Religion

(1) High rank educationally
  (a) Practically no illiterates
  (b) The school system
(2) No state church
  (a) Distribution of Protestants and Catholics

IX. Government

(1) Relation of Kaiser to states
(2) Powers of emperor
(3) The Chancellor
(4) Legislature
(5) Judicial department
(6) Colonial holdings

X. History

(1) In earliest times
(2) The era of Charlemagne
(3) The feudal period
(4) The Holy Roman Empire
(5) Struggle between Emperor and Pope
(6) The Hohenstaufen Dynasty
(7) The Reformation
(8) The Thirty Years' War
(9) The rise of Prussia
(10) The Napoleonic Era
(11) Rivalry of Austria and Prussia
(12) Franco-German War and establishment of the empire
(13) Recent development
(14) The War of the Nations

Questions

Why are not all the inhabitants of Germany Germans in the same sense in which the people of the United States are Americans?

In what way do the "folk schools" differ from primary schools in the United States?

What great emperor had to humble himself and don the guise of a beggar, and why?

In what sense was Frederick the Great the forerunner of Bismarck?

What characteristic have the Germans which takes the place of English determination and French quickness?

What typically German river has neither its source nor its mouth within Germany?

At the outbreak of the War of the Nations, how many countries surpassed Germany in value of manufactures?

How does Germany rank as regards percentage of illiteracy?

Why does not the Chancellor resign if an important policy which he has brought forward is defeated?

What was the Iron Crown of the Lombards, and when did it play a part in the history of Germany?

What were the chief effects of the Thirty Years' War?

What does the expression "a place in the sun" signify, and how has it been used in connection with Germany?

How might the history of this country have been different if there had been no mountain systems?

What product still obtained along the Baltic coast was famous in the days of the Roman Empire?

What medieval king of Germany was made famous by one of the greatest music dramas of modern times?

When did the nailing of certain "theses" on a door change the history of a continent?

How far can you travel in a straight line in Germany?

How does the highest point in Germany compare in altitude with the highest in France? In England? In Alberta?

How does Germany rank as a coal producer? As an iron producer?

How many countries have a greater railroad mileage? How many have a greater mileage in proportion to population?

How did the Franco-German War help in the founding of the empire?

What part of North America is approximately in the same latitude as Germany?

Why are the transient birds of the country very numerous?

Who deliberately plunged the nation into war in order to humble a rival?

What mountains in Germany are not called mountains?

What early battle on German soil ranks among the world's decisive conflicts?

How many countries of Europe have a greater average density of population?

What is the difference in the ordinary meaning of the word *gymnasium* in Germany and in America?

What is the first known fact in the history of Germany?

How many countries of Europe are larger than Germany? How many states of the United States? How many provinces of Canada?

What is there of peculiar interest about the distribution of Catholics and Protestants in the Empire?

Elberfeld
Ems
Erfurt
Essen
Frankfort-on-the-Main
Frankfort-on-the-Oder
Halle
Hamburg
Heidelberg
Jena
Karlsruhe
Kiel
Königsberg
Krefeld
Leipzig
Lübeck
Ludwigshafen
Magdeburg
Mainz
Mannheim
Metz
Munich
Münster
Nuremberg
Oberammergau
Osnabrück
Posen
Potsdam
Ratisbon
Rostock
Stettin
Strassburg
Stuttgart
Ulm
Wiesbaden
Wittenberg
Worms
Würzburg

COLONIES

See list in article above.

HISTORY

Augsburg Confession
Balance of Power
Berlin, Congress of
Counter-Reformation
Elector, German Imperial
Franco-German War
Free Cities
Golden Bull
Hanseatic League
Hessians
Hohenstaufen
Hohenzollern
Holy Alliance
Holy Roman Empire
Lützen, Battles of
Peasants' War
Reformation
Sadowa, Battle of
Schmalkaldic League
Seven Weeks' War
Seven Years' War
Succession Wars
Thirty Years' War
Trent, Council of
Triple Alliance
Vienna, Congress of
War of the Nations
Zollverein

Much of the history of the country is contained in the articles on the rulers or other distinguished men:

Bethmann-Hollweg
Bismarck-Schönhausen, Prince
Blücher, Gebhard von
Bülow, Prince von
Charlemagne
Charles
Ferdinand I and II
Frederick I, Barbarossa
Frederick I, II and III
Frederick William I, III and IV
Henry III, IV and VI
Hindenburg, Marshal von
Louis, the German
Luther, Martin
Maximilian I
Moltke, Count von
Stein, Baron von
Tilly, Count of
Wallenstein, Duke of
William I and II

ISLANDS

Admiralty
Bismarck Archipelago
Helgoland
Ladrone
New Guinea
Samoa

MOUNTAINS

Alps
Black Forest
Harz
Jura
Riesen-Gebirge
Vosges

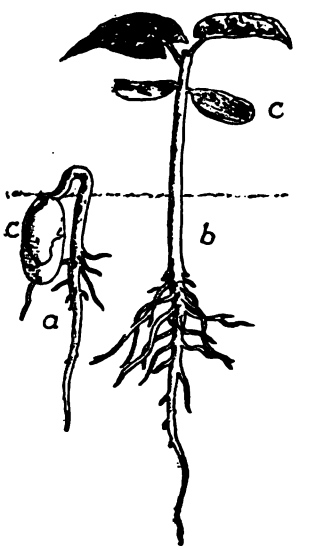
RIVERS

Danube
Elbe
Rhine
Spree
Vistula
Weser

STATES

Alsace-Lorraine
Baden
Bavaria
Brandenburg
Brunswick
Hanover
Hesse
Mecklenburg-Schwerin
Oldenburg
Palatinate
Pomerania
Posen
Prussia
Saxony
Schleswig-Holstein
Silesia
Württemberg

GERMINATION, *jer mi na'shun*, the process by which the germ of a plant organism begins to develop into a perfect plant. The term is derived from the Latin *germen*, meaning *bud*, and is often used interchangeably with *sprouting*. The miracle of growth — the emergence of a tender green shoot from the moist, warm earth in the spring time, after the planting of the ripened seed — is one of the most familiar and yet one of the most wonderful facts in nature. What has taken place is the awakening to activity of the germ of life—the *embryo*, or inner kernel, of the seed. The embryo is itself a miniature plant, and in many cases it has a fairly definite set of organs—a little point at one end called the *hypocotyl*, which is a rudimentary stem; one or two seed leaves, called *cotyledons;* and a *plumule*, or seed bud. See SEEDS.



GERMINATION

Two stages in the growth of the bean. (*a*) Taproot; (*b*) hypocotyl (the portion of the stem below the cotyledon); (*c c*) the cotyledon.

There are three conditions which are necessary for the sprouting of a seed. These are warmth, moisture and a supply of oxygen. Different plants vary in their temperature requirements, and the farmer must learn by experience when to sow the various grains and vegetables. Corn planted too soon will decay in the ground, but peas can safely be sown not long after the soil is free from frost. The following table shows the temperatures required by a few well-known plants; the degrees are on the Fahrenheit scale:

	LOWEST	HIGHEST	MOST FAVORABLE
Barley	32°-41°	100.4°	84°
Wheat	32°-41°	107.6°	84°
Indian Corn	49°	115°	91.4°
Squash	57°	115°	91.4°
Muskmelon and Cucumber	60°	117°	93°

Moisture softens the outer coat of the seed, relaxes the tissues of the embryo and also dissolves certain food materials present in the seeds so they may be assimilated. Too little moisture and too much are equally injurious to growth, for the first condition retards germination, and the second causes many species to decay because of lack of air. A supply of oxygen is necessary, because without this substance certain chemical changes which accompany growth cannot take place. The time required for germination varies greatly with different plants. Seeds of trees and shrubs usually take more time to sprout than do those of grains, grasses and vegetables; the ash and hornbeam, for instance, do not grow until the second spring after the sowing. Parsley seeds sprout in about two weeks, and those of grains, grasses and many herbs of the pea family in from two to eight days.

Examples of Germination. The bean is a good example of those plants which have two seed leaves (cotyledons), both of which rise above the ground during the growing process (see COTYLEDON). First, the outer coat of the seed (the *testa*) splits open, and a conelike outgrowth pushes its way downward into the soil, soon developing a covering of fine hairs on its sides. This is the beginning of the root system of the plant. Then the cotyledons burst open, and as they rise from the ground a green stem develops between them and the roots in the soil. Under the action of the sunlight the cotyledons turn green, but as the nourishment stored in them is absorbed by the plant they wither and fall. Their place, however, is taken by a pair of true leaves, which, with the developing root system, supply the young plant with food.

The pea, another plant with two seed leaves, germinates differently, for its cotyledons remain in the ground while their nourishment is being absorbed, and the first leaf that appears above ground is a true leaf. The germination of seeds having but one cotyledon is illustrated by that of the Indian corn. Here the nourishment is stored at the large end of the kernel. As in case of the pea, the nourishment is absorbed while the seed leaf remains underground, and the first leaf above ground is a true leaf. W.F.R.

GERM THEORY OF DISEASE. See DISEASE, subtitle *Disease in the Human Body.*

GEROME, *zha rom',* JEAN LEON (1824-1904), a French painter and sculptor, considered one of the most eminent artists of the later nineteenth century. He received practically all of his early training from Paul Delaroche; this was supplemented by extensive travel. His work is remarkable for perfect drawing and grouping, although critics consider his color often lacking in warmth. Most of his pictures are in French museums, but he is also well represented in American collections, particularly the Metropolitan Museum, New York City. Some of his famous paintings are *Gladiators from Caesar, The Age of Augustus, Slave Market in Rome, Death of Caesar* and *Duel After a Masked Ball.* With the article CAESAR is a faithful reproduction, in halftone, of the *Death of Caesar.*

GERONIMO, *je ron'i mo* (?1834-1909), an Apache chief of the Chiricahua band, who during the years 1884 and 1886, as the leader of a band of savages, made hostile raids into New Mexico and Arizona. General Crook forced him to surrender in 1886, but on the march to Fort Bowie, where imprisonment awaited them, the Indians escaped and renewed their depredations. The vigorous measures of General Miles, who replaced General Crook, resulted in the second surrender of Geronimo, who was sent to Fort Pickens, Fla., and later to Fort Sill, Okla., where he was held as a military prisoner until his death.

GERONIMO

GERRYMANDER, *ger i man'der,* a word coined in the United States in 1812, defining an unsatisfactory division of a state into political districts. When Elbridge Gerry was governor of Massachusetts the legislature made a new division of the districts for the election of state senators, grouping the counties together that returned large Federalist majorities. By this means the representation of the Federalist party in the legislature was reduced. One district, under the new law, was so unusual in

[illegible] that it form it was not unlike some [illegible] animal. Nathan Hale, named for the Revolutionary hero, one of the editors of the [illegible] *Messenger*, drew the geographical figure and exhibited it at a dinner party. Some said it looked like a salamander. "No," said another, "it is a *Gerrymander*." For years the word was used by the Federalists as a term of contempt for the governor and the Demo-

THE FIRST GERRYMANDER

The misshapen district suggested to opponents of the responsible political party the addition of forked tongue, wings and claws.

cratic legislature which had established the artificial redistricting of the state. The word has been fully incorporated into the language, and is used very generally in its verb form.

Many states are *gerrymandered* by nature. The most famous gerrymander in the United States since the original one of 1812 was the "shoestring district" (Sixth Congressional) in Mississippi. It was formed to minimize the negro vote, and consisted of all the counties in the state along the Mississippi River; it was about 300 miles long and only about twenty miles broad.

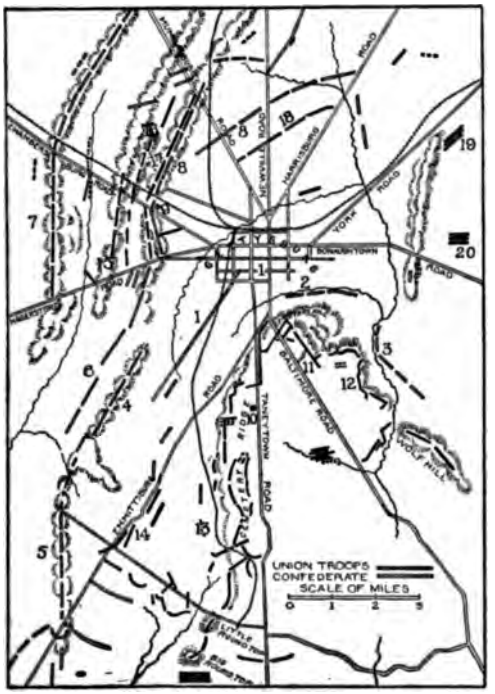
Elbridge Gerry (1744-1814) was the governor of Massachusetts whose name is perpetuated in the word *gerrymander*. He was born in Marblehead, Mass., was graduated at Harvard College in 1762, and died at Washington, D. C., November 23, 1814. At the time of his death he was Vice-President of the United States. He was a signer of the Declaration of Independence, a member of the United States Constitutional Convention, a member of Congress [illegible] years, and in 1797 was sent to [illegible] establish diplomatic relations with that country. His term as governor of Massachusetts was from 1810 to 1812.

GETHSEMANE, *geth sem'a ne*, a beautiful garden filled with olive trees located about a mile east of Jerusalem, between the River Kedron and the Mount of Olives. During His mission on earth Jesus often retired to this spot for meditation and prayer. It is now forever sacred, because it was the scene of His agony, His betrayal by Judas and His arrest. Although the exact location is not known, the Latins have built a wall around a plot of ground 140 by 150 feet just across the river from Jerusalem, and have arranged it as a European garden and have preserved it as the sacred spot. The Greeks, envious of the Latins, have inclosed a place a little north beside the Virgin's tomb, and contend that this is the true Garden.

GETTYSBURG, *get'iz burg*, BATTLE OF, a decisive engagement of the War of Secession, generally regarded as the turning point of the struggle between the North and South. Thereafter the fortunes of the Confederacy gradually waned. In this hotly-contested battle, which was fought July 1, 2 and 3, 1863, at Gettysburg, Pa., Lee's magnificent army of Northern Virginia, numbering about 70,000, was defeated by the Federal army of the Potomac, commanded by General George G. Meade. About 93,500 of the Union force of over 100,000 took part in the field operations. After the Confederate victory of Chancellorsville (May 2-4), the two armies lay encamped for some time on opposite sides of the Rappahannock, at Fredericksburg, Va. In the meantime Lee reorganized his forces, which he divided into three sections, placing over them Longstreet, Ewell and A. P. Hill. He then laid his plans for a second invasion of the North, hoping thereby to defeat the Federal army, capture Washington, and bring the war to a close favorable to the Confederacy.

On June 3 the main body of the Confederate forces began their northward movement. The Federals followed, and on July 1 the advance forces of the two armies faced each other at Gettysburg, which lies at the foot of two ridges. Directly to the south is the one known as Cemetery Ridge, which is shaped like a fishhook. Three elevations crown its summit, Culp's Hill, at the barb of the hook, and Little Round Top and Round Top, at the other extremity. A mile to the west rises Seminary Ridge, which was occupied by Lee's army as its various divisions arrived.

On the morning of July 1 the Federal advance was forced through the town to Cemetery Ridge, where a strong defensive position was taken. Both sides lost heavily during the day. That night and the following day nearly the whole of each army was brought on the field, and the battle was resumed in earnest



THE FIELD OF GETTYSBURG

1—Rode's division	11—Howard's corps
2—Ewell's division	12—Slocum's corps
3—Johnson's division	13—Sickles' corps
4—Pickett's division, July 3.	14—Sickles' advance, July 2.
5—Longstreet's corps	15—Meredith's corps
6—A. P. Hill's corps	16—Cutler
7—Hith's division	17—Reynolds
8—Ewell's corps	18—Schurz
9—Lee's headquarters	19—Stuart's cavalry
10—Meade's headquarters	20—Gregg's cavalry

during the afternoon of July 2. The Federals formed their line along Cemetery Ridge, from Culp's Hill to Round Top. The Confederates opened the attack, driving back the Union left under General Sickles, with terrible loss on both sides, and securing a temporary foothold on a section of Culp's Hill. From this position, however, they were driven out early on the morning of July 3.

The crucial attack of the battle began at one o'clock, on the third day. Lee, against the advice of Longstreet, decided to make a general assault on the Union center, under the command of General Hancock. For nearly two hours the valley between Cemetery and Seminary ridges reëchoed to the sounds of a furious cannonade. Finally the Union commander gave the order to cease firing, so that the guns might cool. At three o'clock, Lee, thinking that he had silenced the batteries of the enemy, ordered General Pickett to charge the Federal line.

Then occurred one of the most magnificent and daring attacks in history, almost worthy to be compared to the famous charge of the Light Brigade at the Battle of Balaklava (see CHARGE OF THE LIGHT BRIGADE). Fifteen thousand of the flower of the Confederate army swept across the valley and up the slopes of Cemetery Ridge, facing a murderous fire that sent great numbers to their death. They carried the first line of the Federal center in a desperate hand-to-hand fight, but no human force could withstand the storm of shot and shell that met them. "Here the great wave of attack reached its high-water mark; here its terrible force was spent and the tide turned, never to rise again" (Montgomery).

This was practically the end of the Battle of Gettysburg, and by the morning of July 5, the Confederates were in full retreat towards Virginia. Meade's losses were so serious that he made no attempt to pursue the retreating army. The official estimate of the Union loss is 23,003; of the Confederate, 20,451. On November 19 of the same year, President Lincoln delivered his immortal *Gettysburg Address* at the dedication of the National Cemetery on Cemetery Ridge.

The Gettysburg Address. In ten sentences, containing only 267 words, spoken under the inspiration of a great and solemn assemblage, Abraham Lincoln gave to the ages America's noblest example of oratory. It was a masterpiece of logic, faultless in sentence structure, forceful in its choice of words, and above all, breathed the purest patriotism—the kind which grips men's hearts and stamps immortal truths upon their minds. In the simple manner characteristic of the man, he said:

> Fourscore and seven years ago, our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated in the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting-place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But in a larger

sense we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The brave men, living and dead, who struggled here, have consecrated it far above our poor power to add or detract. The world will little note, nor long remember, what we say here, but it can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us, —that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion,—that we here highly resolve that these dead shall not have died in vain,—that this nation, under God, shall have a new birth of freedom,—and that government of the people, by the people, for the people, shall not perish from the earth.

GEYSER, *gi'ser,* or *gi'zer.* In the volcanic regions of Iceland, New Zealand and Yellowstone National Park there are very striking exhibitions of the earth's internal heat in the wonderful natural fountains, called *geysers,*

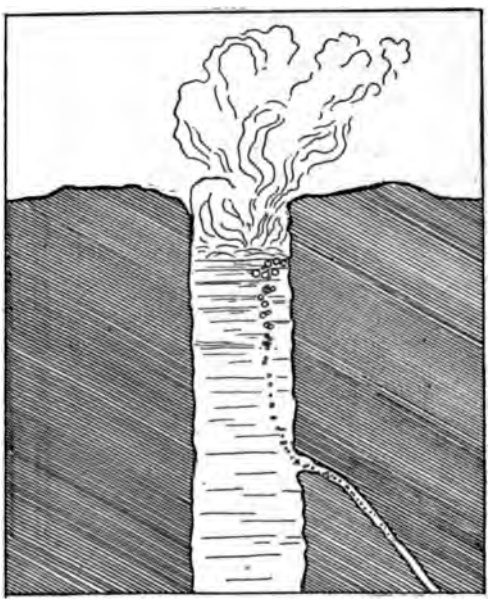


DIAGRAM OF GEYSER
Showing the tube and one of the fissures for supplying the tube.

from which streams of boiling water and steam shoot high into the air at varying intervals. Geysers have often been compared to volcanoes, for they act much the same, but instead of molten rock, they shoot forth water con- in solution.

Action. Geysers form along the inage, that is, near rivers and the surface water which works gh cracks in the rocks and lava, until, at some unknown depth, it comes in contact with rocks sufficiently hot to boil it. The rocks are much hotter than is necessary to heat the water to the boiling point, and as more water trickles down, the pressure of the cooler water near the surface becomes very great on the boiling water beneath.

When the pressure of the steam formed at the bottom becomes stronger than that from above, the steam must escape, so it forces the water above it up through an opening in the rocks, called a *tube.* As soon as a little of the water overflows upon the surface of the earth the pressure below is relieved, and the steam shoots out, taking a great amount of water with it. The eruption occurs very suddenly, and after it ceases much of the water which falls around the geyser evaporates, leaving deposits of silica or lime carbonate that often take on beautiful and fascinating forms.

Some geysers, such as the Giantess in Yellowstone National Park, never form cones, but appear as pools of wonderfully clear water, except when in action. Very little water is left after an eruption in those which have cones, except in such cases as that of the tiny Model, also in Yellowstone National Park, where all the water ejected falls back into the cuplike cone and returns to the depths of the earth to be reheated. The eruption of geysers is caused by the gradual filling of the crater with water, which is forced up by the steam generated in the cavity below. The water prevents the escape of the steam, and as it rises in the crater, the pressure of steam below increases. Finally, the water reaches the top of the crater, and begins to overflow. With the overflow the pressure in the crater lessens and the steam under high pressure expands with such force as to drive all the water out of the crater, often throwing it over a hundred feet into the air. After the water has been expelled a flow of steam follows for several minutes. The geyser then becomes quiet and remains in this state until the crater is again filled, when another eruption occurs.

In course of time geysers cease to act and become hot springs. However, this process is very slow and the formation of new geysers offsets the decay or drying up of old ones, so that it will be thousands of years before they cease to exist. The prevalent idea that geysers erupt at regular intervals is false, although a few geysers, such as Old Faithful in Yellowstone Park, send forth their shower at somewhat definite periods.

Their Distribution. In Iceland the volcanic forces are still active, and in New Zealand the recent eruption of Tarawera showed that molten rock still exists; but in Yellowstone National Park, where there are sixty active geysers located on an elevated volcanic plateau, there are no evidences of fresh lava flow. In the barren lava fields of Iceland, which is well named the land of frost and fire, are located the Geyser and the Strokhr, the two famous geysers of that region, seventy miles from Reykjavik, Iceland's capital. In strong contrast is the location of the New Zealand geysers, which are situated in a country clothed in luxuriant vegetation. The delicate "pink and white terraces," which rise like stairways of beautifully sculptured marble above the dull green waters of Lake Rotomahana, in that country, were formed from the Terata geyser, standing like a fountain at the head of the stairway.

Yellowstone National Park contains the largest and most active geyser region in the world. See YELLOWSTONE NATIONAL PARK; ICELAND; NEW ZEALAND. E.S.

Consult Dana's *Geology;* Hague's *Geology of the Yellowstone National Park.*

GHATS, or **GHAUTS,** *gawtz,* two ranges of mountains running parallel with the east and west coast of India, generally known as the Eastern and Western Ghats. The Western Ghats are more continuous than the Eastern range, and extend from the River Tapti to Cape Comorin, the most southerly point of the peninsula, with peaks varying from 4,000 to 8,700 feet in height. The Eastern Ghats have an average height of 1,500 feet.

The term *ghats* is also applied to landing places by the side of Indian rivers, with broad flights of stairs leading to long, high buildings or temples. Up and down these ghats, especially those on the banks of the sacred River Ganges, thousands of Hindus pass daily to and from their bath in the holy waters.

GHEBERS, *ge'burz,* or **GABERS,** *ga'burz,* is a name applied to the followers of the ancient Persian religion of Zoroaster (which see). When the Mohammedans invaded Persia in the seventh century, the Ghebers were driven to the western coast of India, where they are now known as the *Parsees.* The few remaining in Persia are found chiefly in Kirman or Yezd, and have been reduced by persecution to poverty and ignorance. Those who settled in India are among the highest native classes, and are regarded with favor by reason of their honesty, morality and observance of the law. They do not bury their dead, but expose them on what they call "Towers of Silence," but this custom is dying out gradually, owing to the opposition of the British government. They worship fire as an emblem of purity and good. They have strict regulations as to diet, and do not marry outside their own people. See PARSEES.

GHENT, called *gent* in America, but *gông* in Europe, is the capital of the province of East Flanders, in Belgium. It was founded in the seventh century by Baldwin, the first Count of Flanders, and it grew in importance until in the fifteenth century it became the chief center of European textile industries. It is situated at the junction of the Scheldt and Lys rivers, thirty-one miles northwest of Brussels. Like all Belgian cities, it is intersected by a network of streams and canals, crossed by more than 200 bridges. The older portion of the town is of great interest to tourists, having a medieval aspect and possessing many buildings of historic interest. The cathedral, part of which dates from 941, has a plain exterior for which the splendidly-decorated interior amply compensates. The town hall, erected in the sixteenth century, is the finest example of Gothic architecture in Belgium.

Although Ghent has greatly declined in commercial importance its industries were still extensive at the outbreak of the War of the Nations in 1914. It has a number of linen, wool and cotton mills, lace factories, tanneries, breweries and sugar refineries. The city is also noted for its flowers, which in times of peace are exported to all parts of Europe. Since the days of its foundation, Ghent has been a center of strife and war, and its citizens have at all times shown their willingness to take up arms in defense of their privileges and property. In the fourteenth century the wealthy merchants of the city maintained an army of 20,000 men. In 1794 Ghent was annexed to France, becoming the capital of the Department of the Scheldt. It became part of the kingdom of the Netherlands in 1814, and was retained by Belgium when that country obtained its independence in 1830. The city was occupied by the Germans, without opposition, at the outbreak of the War of the Nations, and because bombardment was avoided, the historic buildings were preserved. The treaty which ended the War of 1812, between Great Britain and the United States, was signed here. Population in 1912, 167,177.

reaty of Ghent, the treaty which ended the .r of 1812 between Great Britain and the ited States. It was signed December 24, 14, and ratified February 17, 1815. The merican negotiators were John Quincy Adams, ames A. Bagard, Henry Clay, Jonathan Rus-ell and Albert Gallatin. The terms of the reaty restored all territory to its ownership previous to the war, appointed a commission to settle matters relating to the international boundary and bound both America and England to use their utmost influence to stamp out slavery. Many points which afterwards caused friction were overlooked, and it was generally felt that the United States negotiators had not strongly insisted on a cessation of impressment of American seamen, one of the chief causes of the war. However, that issue never again appeared in the relations of the two countries. The rights of Americans to participate in the Newfoundland fisheries were also overlooked. These matters were settled by subsequent negotiation. F.ST.A.

GHETTO, *get'o,* the Jewish quarter of a large city. The word is probably derived from the Talmudic word *ghet,* signifying *separation.* In the Middle Ages the Jews' quarter of a large town was known as the Ghetto, outside of which they were not permitted to take up residence. The name now has no legal significance, but is popularly applied to the section of a large city occupied of their own choice by Jews of the poorer classes. The largest and most densely-populated Ghetto in the world is located on the "East Side" in New York City, where a single city block contains 3,000 to 5,000 population. Six hundred persons are often housed in one tenement building, the majority of them being employed in sweatshops (see SWEATSHOP SYSTEM). The population of the New York Ghetto is estimated at 350,000.

The Ghetto originated in Rome, instituted by Pope Paul IV. He allotted the Jews a distinct quarter, comprising a few narrow, unhealthful streets on the banks of the Tiber River, and extending from the bridge, Quattro Capi, to the present Place of Tears. Walls and gates that could be guarded enclosed the "Jews' Suburb." On the twenty-sixth of July, 1556, the Jews entered the Ghetto, weeping and wailing, like their ancestors when taken into the Captivity. In the eighteenth century Innocent XIII decreed that the Jews should have no other trade or profession than in rags, old clothes and broken iron, which was called *stracci feracci.* In 1740 Benedict XIV permitted them to add to this the trade in new cloth wares, which in Rome they carry on to the present day. Pius IX was more liberal than his predecessors, for he ordered the walls of the Ghetto pulled down, and the Jews are now at liberty to reside where they please in Rome. The Ghetto of London has been presented in fiction by Zangwill in his *Children of the Ghetto* and the New York East Side life has been depicted in the works of Henry Harland, Abraham Cahan and Hutchins Hapgood.

Consult Hapgood's *Spirit of the Ghetto;* Philipson's *Old European Jewries.*

GHIBELLINES, *gib'el linz.* See GUELPHS AND GHIBELLINES.

GHIBERTI, *ge bair'te,* LORENZO (1378-1455), ranks highest with Donatello, his friend, among the grand Italian sculptors and goldsmiths of the Renaissance. His art has been perpetuated by his bronze gates for the baptistery of Florence, which in beauty of ornamentation and perfection of form and finish in every detail have never been equaled. They are counted among the finest works of art in Italy, and far surpass anything of the kind attempted since the days of the ancient Greeks. They must still have shone with all the brightness of their original gilding, when, a century later, Michelangelo pronounced them "worthy to be the gates of Paradise." The first gate, upon which Ghiberti was engaged for twenty years, consists of twenty-eight panels, representing incidents in the lives of Christ, the fathers of the Church, and the Evangelists. So greatly was this admired that the artist received the order for a second gate, which took as much time to complete; the subjects this time were taken from the Old Testament.

Next to the gates for the baptistery, Ghiberti's chief works still in existence are the three statues of Saint John the Baptist, Saint Matthew and Saint Stephen. In the church of San Michele, at Florence, are to be found bas-reliefs, statues and some excellent pairs of glass windows. He also is famed as an architect, but his skill as a sculptor and goldsmith far eclipsed his other attainments. Ghiberti died at the age of seventy-seven in his native city, Florence.

GHIRLANDAJO, *geer lahn dah' yo,* DOMENICO DEL (1449-1495), occupies a prominent place among the Florentine painters of the Renaissance. Not until the age of thirty-one did he begin his life work, and in a brief period of fourteen years he became one of the

proficient painters of his time, presenting the life of the Renaissance as he saw and knew it in the town which he knew and loved best—his native Florence.

Ghirlandajo, which means *garland-maker,* was a nickname that clung to Domenico from the employment of his father, who fashioned the metallic garlands worn by the Florentine maidens. His first work of importance, the frescoes in the Sistine Chapel, are notable for their excellence in composition and perspective. Among his best works are the frescoes in the Sassetti Chapel of the Trinity Church and in the choir of Santa Maria Novella at Florence; and his paintings, the *Last Supper, Saint Jerome, Coronation of the Virgin* and *Adoration of the Kings,* now in the Academy at Florence. Ghirlandajo had a happy faculty of bringing many notable personages of his day into his paintings, which makes his work invaluable to the student of his time.

GHOSTS, *gohsts,* shadowy figures of the dead as imagined by living persons. The belief in ghosts has furnished topics for countless gruesome stories and has led to many superstitious fears. They have been credited with remarkable powers, and in the past terror was felt for the returning spirit of anyone who died a violent death or who was concerned with a murder. Tales of haunted houses show that this feeling still exists, but in most civilized countries nowadays ghosts merely furnish a topic which permits of unlimited play of the imagination in stories told at dusk or in the dim firelight's glow.

One of the most famous ghosts in literature is that of Hamlet's father, in Shakespeare's tragedy *Hamlet.* Marley's Ghost in Dickens' *The Christmas Carol* changes a miserly, hard old man to a cheerful, helpful giver. *Ghosts,* one of Ibsen's most thrilling dramas, is a ghost story showing the results of inherited evil.

Various theories have been advanced concerning belief in ghosts. It has been suggested that it arose from dreams. A dream in which a dead person figures may have been so realistic the dreamer believed the dead had really come back in person; or the dreamer may have believed that while sleeping his own soul left his body and visited and talked with the dead. At any rate, the belief in the return of the dead in the form of ghosts has played an important part in religious beliefs, and various religious theories have developed therefrom, such as ancestor worship, belief in immortality, witchcraft, nature worship and totemism (see IMMORTALITY; WITCHCRAFT; TOTEM). North American Indians have a religious dance called the *ghost dance,* which is performed at night and for which a white cloak is worn. The superstitious fears of negroes are well known, and acting on that knowledge, the Ku-Klux Klan, with its ghostly garments, was organized in the Southern United States at the close of the War of Secession, to frighten negroes into political submission.

Consult O'Donnell's *Ghostly Phenomena;* Jastrow's *The Study of Religion.*

GIANTS, *ji'antz,* a word commonly applied to unusually tall men and women. The average height of men throughout the world is about five feet five inches; but each race has an average height of its own which changes little from generation to generation, and which often varies considerably from the general average of all men.

Machnow, a Russian, born at Charknow, was exhibited in London in his twenty-third year, in 1905; he was then nine feet three inches in height and weighed 360 pounds. From his wrist to the tip of his second finger he measured two feet. Chang-wu-gon, a Chinese giant, was seven feet nine inches high; Anna Swan, a native of Nova Scotia, and her husband, Captain Bates, a native of Kentucky, each measured over eight feet.

It was the general belief of the ancients that the human race in their day had degenerated, the men of primeval ages having been of so far greater stature and strength as to be gigantic. The idea conveyed by the word in classic mythology is that of beings more or less manlike, but enormous in size and strength. Giants of Greek mythology were believed to personify the elements of nature and were said to have sprung from the blood of Uranus (Heaven), which fell into the lap of Ge (the Earth).

Giants figure largely in Celtic and Scandinavian mythology and legends. The giants Fingal and his son Ossian belong to the legends of the Irish. The giants of the Welsh are familiar to everyone through the achievements of Jack the Giant Killer.

Races of giants are first mentioned in the Bible in *Genesis* VI, 4.

Og, the King of Bashan, had a bedstead nine cubits long, a cubit being 25.19 inches. Goliath, who measured six cubits and a span, and who was slain by David, is the most celebrated of the giants mentioned in the Bible.

GIANTS' CAUSE'WAY, a remarkable group of basaltic rocks on the north coast of County Antrim, Ireland. The causeway proper is a promontory formed of about 40,000 columns, fitting into each other perfectly and jointed

GIANTS' CAUSEWAY

horizontally. Some of the pillars are twenty feet in height, and vary in diameter from fifteen to twenty inches. Different groups are known as the *Wishing Chair, Lady's Fan, Giants' Loom, Giants' Organ,* etc. The peculiar pillarlike construction of the rocks is declared by geologists to result from contraction in the cooling of the lava of which they are composed. The Giants' Causeway derived its name from the legend which ascribes its construction to Finn M'Coul, or Fingal, who bridged the channel from Ireland to Scotland in order that the giants might pass from one country to the other.

In 1883 an electric railway, the first in the United Kingdom, connecting the Causeway with neighboring towns, was opened for traffic. An admission fee is charged, as in 1898 the Causeway and certain neighboring territory were declared to be private property.

GIBBON, *gib'un,* a small, tailless anthropoid, or manlike ape, belonging to the same family as the gorilla and chimpanzee. It is found in all parts of the East Indies, where it inhabits the forests, living almost entirely in the trees and traveling with great rapidity through the tangled growth. Its color is black, with a white fringe or beard surrounding the face. Gibbons are extremely awkward on the ground and move with difficulty, using their extremely long arms to balance themselves, but never creeping on all fours. At night they sleep [redacted] a ball in the branches of trees or [redacted]tructed platforms.

[redacted]l food consists of fruit and nuts, frequently kill and eat small birds. They are easily tamed, and when in captivity soon acquire a taste for all cooked foods. The long-armed gibbon of Sumatra is said to display wonderful agility in springing from tree to tree, clearing with ease a space of forty feet. In their native haunts gibbons are very noisy, chattering incessantly; they are particularly so in the early morning, when they greet daylight with a concert of long-drawn-out "wa-hoos." The origin of the name is unknown.

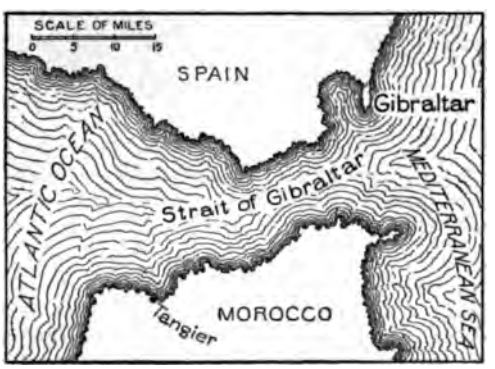
GIBBON, EDWARD (1737-1794), was an English historian whose reputation in connection with a great history of the Roman Empire makes his fame secure. He was born in Putney, Surrey. Owing to much illness in childhood his education was irregular. He entered Magdalen College, Oxford University, in 1752, and was expelled after fourteen months on account of his profession of the Roman Catholic faith. He soon renounced this creed, doubtless influenced by the arguments of the Calvinistic minister at Lausanne, under whose instruction he was placed following his expulsion from Oxford. In 1758 he returned to England, and in 1774 was elected to Parliament.

EDWARD GIBBON
"His writing was as poetical as a picture."

His life work was the *History of the Decline and Fall of the Roman Empire,* which is considered not only one of the greatest histories ever written, but a remarkable literary achievement. While it has been attacked in minor points, in essentials it is still the standard authority for the period it covers. It is really a history of the civilized world for the thirteen centuries during which paganism was weakening and Christianity was gaining a foothold. An important criticism is that owing to the author's lack of religious belief at the time the history was written he belittled the influence of Christianity as a civilizing factor. Byron termed Gibbon "the lord of irony," referring to his stately and measured style. Some critics consider the historian at his best in his autobiography, which was published after his death under the title of *Memories of My Life and Writings.*

GIBBONS, *gib'unz,* JAMES (1834-), a Roman Catholic churchman of wide scholarship and influence, the first American to be created a cardinal. He was born in Baltimore, but began his education in Ireland, where he remained until he was fourteen years of age. Completing his studies at Saint Charles' College, Maryland, and at Saint Mary's Seminary, Baltimore, he was ordained a priest in 1861. He began his work as assistant in the parish of Saint Patrick's, Baltimore, was transferred to Saint Bridget's, in Canton, a suburb of Baltimore, and later became secretary to Archbishop Spalding. Through the offices of bishop and vicar apostolic of North Carolina, bishop of Richmond and coadjutor archbishop of Baltimore, he rose to the rank of archbishop of Baltimore, succeeding Archbishop Bailey in that dignity in 1877. Nine years later he attained the highest honor of his career—his appointment as cardinal by Pope Leo XIII. In 1887, the year following, he visited Rome and was formally inducted into membership in the College of Cardinals (see CARDINAL).

Cardinal Gibbons is known throughout America as a man of broad enlightenment and progressive ideals. He is the author of *The Faith of Our Fathers, Our Christian Heritage* and *The Ambassador of Christ.* He was active in the movement looking toward the establishment of peace between the warring nations of Europe in 1915. G.W.M.



GIBRALTAR, A STRONGHOLD OF GREAT BRITAIN

GIBRALTAR, *jib ral' tar,* the strongest fortress in the world, situated on a rocky peninsula near the southernmost point of Spain. It is called the "Key to the Mediterranean." With a small town at the base of the rock it forms a British colony, having been captured by English and Dutch forces in 1704, and assigned to Britain by the Treaty of Utrecht in 1713, at the close of the War of the Spanish Succession (see SUCCESSION WARS). The Rock of Gibraltar rises abruptly from the water and overlooks the narrow strait connecting the Mediterranean Sea with the Atlantic Ocean. The strait is from nine to thirteen miles wide; all vessels passing through it come under the muzzles of the huge guns of the fortress. The rocky promontory on which the fortress stands is connected with the mainland by a low sandy isthmus one and a half miles long and three-fourths of a mile wide. This strip forms a "neutral zone" between Spain and Britain's rock, and the approach is guarded by guns and mines. Guns of the largest caliber and newest design also protect the sea front, the rock being inaccessible.

Gibraltar seen from the sea appears to be a dark, somber and forbidding mass of marble, but hidden from sight from the strait are beautiful, grassy, wooded glens where flowers grow, and where partridges, woodcocks and other game birds are found in large numbers. Small Barbary apes inhabit the rocks and many are captured and kept by the soldiers of the garrison. The approaches to the fortress are strictly guarded, and there are many secret passages and storehouses cut in the rock, their positions being jealously guarded by officials. The garrison usually numbers about 5,000 men.

Strait of Gibraltar, the narrow channel between the "Pillars of Hercules," connecting the Mediterranean Sea and the Atlantic Ocean, and separating Spain from the northern coast of Africa. It is forty miles long and varies in width from nine to thirteen miles. There is practically no tide in the Mediterranean, and it has been found that there is a continuous under-current flowing westward through the strait, carrying the surplus waters of the landlocked sea into the ocean. See HERCULES, PILLARS OF.

Consult Field's *Gibraltar;* Lang's *Gibraltar and the West Indies.*

GIBSON, CHARLES DANA (1867-), American illustrator and artist, famous

drawing of a characteristic society woman which has become known as the "Gibson Girl." He was born in Roxbury, Mass., studied at the Art Student's League, New York, under Saint Gaudens and Julian in Paris, and later went to London and Munich for further work. He first achieved prominence by his illustrations in *Life*, the *Century*, *Scribner's* and *Harper's* magazines. He is acknowledged as one of the greatest living masters of black and white, and is perhaps best known through his humorous, inoffensive ridicule of the shams of society. At one stage in his career *Collier's Weekly* secured exclusive control of his services for a year at a salary of $100,000. Some of his published works are *The Education of Mr. Pipp*, *A Widow and Her Friends*, and *People of Dickens*. In 1905 he discontinued illustrating for a time and attempted by study in Europe to master color work, but he has since returned to his former field of endeavor.

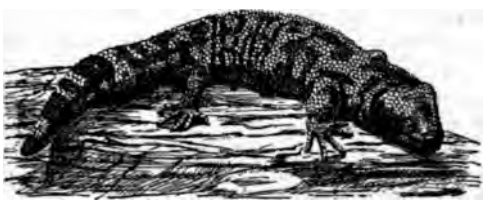
CHARLES DANA GIBSON

GIDEON, *gid'e un*, the fifth judge of Israel, who was called by an angel of God to deliver his people from the Midianites, who were oppressing them. Going to battle with only 300 followers, each armed with a sword, trumpet and earthen pitcher containing a lamp, he gained a splendid victory, with God's help, by attacking the enemy's camp at night (*Judges* VII, 19). Gideon long remained one of the favorite heroes of the Jews.

Gideon's Band, a society of Christian commercial traveling men, formed at Boscobel, Wis., in 1899 to promote the work of God by holding meetings in hotel lobbies and various churches. They publish a monthly magazine, *The Gideon*, in Chicago, and in 1908 began putting Bibles in the guest rooms of hotels. This work has grown until, at the present time, nearly 300,000 Bibles have been placed, mainly in the United States, although they are extending their work to Canada and England. It is planned ultimately to place a Bible in every hotel room in every English-speaking *or* city.

GILA, *he'lah*, a river of the United States which has its source in the Sierra Madre Mountains in New Mexico and flows in a westward direction through mountains and valleys, across Arizona. The ruins of stone edifices, pieces of broken pottery and indications of irrigation canals along the banks of the Gila show that the region was formerly inhabited by a partly-civilized race, the historically interesting and mysterious Cliff Dwellers (which see).

GILA MONSTER, a poisonous lizard, one of the largest of the lizard family in North America, is found in the deserts of Arizona, New Mexico and Texas. It derives its name from its discovery near the Gila River in Arizona.



GILA MONSTER

It is covered with orange and black scales, and has grooved teeth with poison-secreting glands near their base. The bite of this lizard was formerly supposed to be injurious to man, though rarely fatal, but deadly to small animals and birds. Scientific investigation has failed to verify this opinion, so the question of the venomous nature of the reptile is still unsettled.

GILBERT, SIR HUMPHREY (1539-1583), one of the earliest of North American colonizers, first won fame as an English navigator and explorer. During early manhood he attained distinction in the English army. In 1578 he received a commission from Queen Elizabeth to conduct an expedition in search of a new route to India, in which little known land he had become interested. The history of this voyage is obscure, but it availed nothing, as he returned to England the next year, having lost one of his chief ships and one of his bravest captains. Undaunted, however, he started out in 1583 in command of a second expedition, with his half brother, Sir Walter Raleigh. But Raleigh and his ships deserted him soon after their departure from Plymouth. Gilbert this time succeeded in planting a colony near Saint John, Newfoundland. After taking formal possession in the queen's name, he proceeded southward, encountered a storm and was never heard from again.

GILBERT, Sir William Schwenk (1836-1911), an English dramatist who, in collaboration with Sir Arthur Sullivan, a composer, produced some of the world's most popular light operas. Among these are *Pinafore, The Mikado, The Pirates of Penzance* and *Patience.* Theirs was the most successful artistic partnership in history.

Sir Gilbert, who was born in London, studied at London University and later was admitted to the bar. He was knighted by King Edward VII in 1907. When *Fun* was first published in 1861, he secured in it a popular reputation, chiefly by reason of his *Bab Ballads.* His first writing for the stage was entitled *Dulcamara; or, The Little Duck and the Great Quack.* However, his real success began when he entered into a producing partnership with Sir Arthur Sullivan. Their first operetta was *Trial by Jury.* Then followed the five above-mentioned operas, which ever since have delighted theatergoers because of their clean, wholesome, delightful fun, their sparkling wit and tuneful melodies. The Savoy Theater, in London, was built especially for the Gilbert-Sullivan productions. *Pinafore* became almost a world-wide production. At one time ninety companies throughout the United States alone were singing it.

The partnership continued until the death of Sullivan, in 1900. See Sullivan, Sir Arthur.

GIL'DER, Richard Watson (1844-1909), a poet, editor, orator and lover of art, one of the most popular of Americans because of the purity of his patriotism and his tireless endeavor to serve his city and his fellow men. Born at Bordentown, N. J., in early life he planned to follow the legal profession, but the War of Secession made of him a soldier. At its close he entered the field of literature.

At the age of twelve he published a little paper, which he not only wrote but set up and printed himself. He helped to establish the Newark (N. J.) *Morning Register,* and then in New York City became editor of *Hours at Home.* This periodical was merged into *Scribner's Monthly,* and he became its managing editor; and when the latter was changed to the *Century Magazine,* he became the editor-in-chief, which position he filled until his death.

On a par with Mr. Gilder's activities as an editor ranks his work as a poet, and some of his best efforts have been collected in *Five Books of Song, In Palestine* and *Poems and Inscriptions.* Although a poet rather than a man of affairs, he always took an active interest in matters of public welfare, and became the head of several reform organizations. He was the first president of the New York Kindergarten Association, and one of his most significant services to his city was his devotion to the children of the tenements.

GILD'ING, the art of applying gold leaf or gold dust to metal, porcelain, wood, paper or glass. The oldest and best method consists in applying gold leaf to a surface previously treated with sizing, which acts like a glue when partly dry and firmly holds the gold leaf. When applied to cardboard or paper, their surfaces must first have another sizing, to prevent them from absorbing the regular sizing, so the gold leaf will adhere. The frames of mirrors, pictures and moldings are gilded with gold leaf, or a silver leaf to which a yellow varnish is afterwards applied. The edges of books are gilded by coating with glue, preferably fish glue, applying the gold leaf and afterwards polishing.

In gilding ivory a warm sizing is used. In gilding glass, china and pottery gold dust is mixed to form a paint, and this is applied with a brush. The article is then baked in an oven at a low temperature, and later put in a kiln at a high temperature, to secure permanency. If such dishes are washed in soap a great deal and not very well rinsed, the alkali in the soap will gradually eat off the gold. In the gilding of iron and steel, gold leaf is sometimes applied after the surface has been well cleaned and heated until it turns a bluish color. In Saint Peter's Cathedral at Rome and the Congressional Library at Washington, D. C., gilding forms one of the chief interior ornamentations; the dome of the State House in Boston is entirely covered with gold leaf.

GIL'EAD, the mountainous country east of the Jordan River, where the tribes of Gad, Reuben and a part of the tribe of Manasseh settled when the Israelites took possession of the Promised Land. It was a splendid pasture, extending from the table-land of Moab north to the River Yarmuk, and became the refuge for many who disagreed with the government during the history of Israel. It was the refuge for Absalom when he fled from his father. Here, too, the Christians found safety when Jerusalem was besieged. A famous balm, obtained in this country from nuts, was used as an ointment and was considered very precious. The expression, "Is there no balm in Gilead" (*Jeremiah* VIII, 22), really means "Is there no place of refuge" and does not refer

he ointment such as Jacob sent to his son
:ph in Egypt (*Genesis* XLIII, 11).

ILLETTE, *jil et',* WILLIAM HOOKER (1855-
), an actor of unusual gifts and one of the
emost American dramatists. He is best
own by his characterization of the title rôle
Sherlock Holmes, which he dramatized from
ir Conan Doyle's stories of that hero. He
as born in Hartford, Conn., the son of a
Jnited States Senator. While playing in stock
companies in New York and Boston he took
special courses at the University of New York
and the Massachusetts Institute of Technology. He began his theatrical career in 1877,
and soon after started writing his own plays.
In *Secret Service* Mr. Gillette carries the War
of Secession theme, which he began with *Held
by the Enemy,* to the highest point such plays
have reached. Two of the best plays recently
produced in the United States are his *Secret
Service* and *Sherlock Holmes.* Others of his
plays are *The Private Secretary, Esmeralda* and
Because She Loved Him So.

GILLS, *gilz,* the breathing organs of fishes,
located in chambers, one on each side of the
head. If the throat of a fish be examined, a
series of four or five slits, called gill-openings,
may be seen. These open to the exterior; the
fish opens its mouth at regular intervals, draws
in a quantity of water, contracts the sides of
its throat when it closes its mouth, and thus
forces the water through the gill-opening, over
the tiny gill-filaments to the exterior. When
the water passes over the gill-filaments the
oxygen is extracted from it by the blood in the
filaments and is carried to other parts of the
body. In sharks these outer openings may be
seen, but in bony fishes the chamber on each
side of the head is covered by a bony plate.
For illustration, see FISH.

GIL'MAN, DANIEL COIT (1831-1908), an
American educator and the first president of
Johns Hopkins University, was born at Norwich, Conn. He was graduated from Yale
College in 1852 and continued his studies in
Europe, in Cambridge University and in Berlin. In 1872 he became president of the University of California, and in 1875 was elected
first president of Johns Hopkins University at
Baltimore, where he remained until 1901. The
Carnegie Institution in Washington, D. C., also
chose him as its first president in the latter
year; he resigned this position in 1904. From
1893 till 1901 he served as president of the
American Oriental Society, and The Russell
e Foundation for Social Betterment appointed him a trustee in 1907. He was also
vice-president of the Archaeological Institute
of America. He published *Launching a University,* an account of the early years of Johns
Hopkins, *Life of James D. Dana,* the geologist,
and *Life of James Monroe.* Dr. Gilman was
also one of the editors of the first edition of
the *New International Encyclopedia.*

GIL'MORE, PATRICK SARSFIELD (1829-1892),
one of the most popular of American musical
conductors, was born near Dublin, Ireland. At
an early age he left his native land for the
United States, and soon after organized Gilmore's Band. In 1869 he arranged the National
Peace Jubilee in commemoration of the close
of the War of Secession in America, and in
1872 the World's Peace Jubilee, after the close
of the Franco-German War in Europe. On the
latter occasion he conducted an orchestra of
2,000 pieces and a chorus of 20,000 voices.
Later he organized the famous Twenty-Second
Regiment band in New York, which gave popular and successful concerts in the United States,
Canada and Europe. He devoted little time to
composing, his only work of note being an
anthem entitled *Columbia* and intended as a
national hymn.

GIN, *jin,* a liquor distilled from grain. The
name is derived from *jenever,* the Dutch word
for the juniper plant, the berries of which are
used to flavor the spirit. By far the larger part
of the spirit is made in Holland where it is
treated in different ways and sold under various names. The ordinary gin sold in the lowest class of drinking places consists of alcohol
flavored with salt and oil of turpentine, and
diluted to alcoholic strength of from twenty-five to forty-eight per cent.

GINGER, *jin'jur,* a valuable and favorite
seasoning and confection, with a warm, burning taste, obtained from the rootstalks of the
ginger plant. Though native to the East Indies, ginger has been introduced into the Wes
Indies, South America and West Africa. Fro
the knotty rootstalks grow grasslike leaves ar
cylindrical stems bearing clusters of whi
purple-streaked flowers. When the lea
wither the roots are dug and dried whole
produce black ginger, or scraped, washed
dried to produce white ginger. If it is to
preserved it is boiled and dipped in sirup e
twenty-four hours for a week. The finest
ger is obtained from the island of Jamaic
is generally sold in the form of an ex
Most of the preserved ginger is imported
China.

Uses. As a spice, ginger is well known to everyone from earliest childhood, through gingerbread men and ginger snaps. And later we meet it in that home remedy, ginger tea, or candied, or in the popular beverage, ginger ale or ginger beer. Ginger wine is a cheap liquor flavored with ginger. The oil of ginger is used to lessen pain. Its commonest use is in seasoning a great variety of foods.

THE GINGER PLANT

Wild Ginger, found in the woods throughout the United States, is a low, woolly plant with beautiful heart-shaped leaves, and one dully-colored, bell-shaped blossom growing close to the ground. A popular remedy for measles and whooping cough is made from the roots of this wild plant.

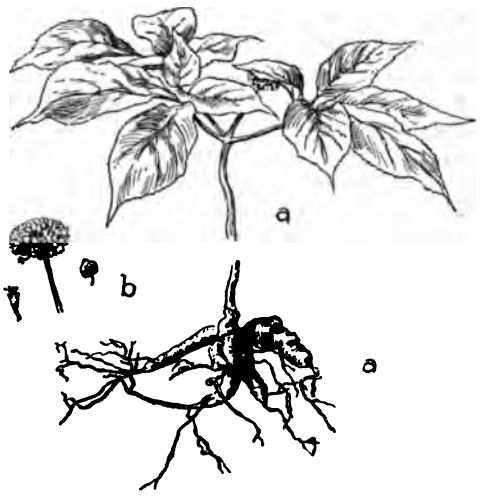
GINGHAM, *ging'am,* originally a smooth, close cotton fabric, woven of two colors of plain-dyed yarns, into checkered, striped and fancy patterns. A greater variety now appears in ginghams than formerly, and they are also woven of silk and cotton mixed, or of silk and ramie. Ginghams were first made in India, but now about 550,000,000 yards of gingham, valued at $40,000,000, are manufactured yearly in the United States alone—an average of over $130,000 worth each working day.

Gingham differs from calico in that the colors are woven with the fabric, not printed on it, as is true of calico, so the cloth is alike on both sides. The name is probably derived from the Japanese word meaning *perishable,* or *fading.*

GINKGO, *gingk'ko,* the beautiful "maidenhair" tree, used so extensively for ornament. It is a very hardy tree as far north as the latitude of Massachusetts and sometimes grows to a height of 100 feet, while the trunk reaches a diameter of eight feet. Its leaves are fine, like those on a maidenhair fern, from which it received its popular name. In Washington, D. C., several streets have been made very beautiful by the planting of many of these trees. For centuries it has been cultivated in Japan and China as a sacred tree in the groves of the temples. The Chinese use the starch kernel of the seed as a food, for it tastes much like an almond.

GINSENG, *jin'seng,* the light-yellow root of a low, wild herb, prized by the Chinese as a remedy for nearly all diseases. The plant, with its three or five leaves and inconspicuous flowers which change to scarlet berries, is found in America from the valley of the Saint Lawrence to the mountains of Georgia and west to the Mississippi; it is also cultivated in China. Some of the roots are shaped a little in the likeness of a human being, and so the name was derived from Chinese words which mean *likeness of a man.* Roots of such shape bring high prices from the superstitious Chinese. The plant is little used by Americans, but when they learned of the demand for it in China it became a valuable article of export, the price per pound rising from 52 cents to as high as $10. The supply of the wild root becoming exhausted, the cultivation of ginseng has been encouraged.

Ginseng will thrive in a soil which is rather loose, well drained and rich in humus, potash and phosphoric acid, but not in nitrogen.



GINSENG

(*a, a*) Top and roots of mature plant; (*b*) flower cluster and its parts.

Since exposure to the full heat of the sun will kill it, ginseng-growers who cultivate the plant in the open protect their crop by erecting a lattice-work covering. Posts six feet high are placed along the beds at intervals of sixteen

[illegible]

[illegible]

PRODUCTION OF GINSENG

The average annual value of the crop in the [illegible] states which lead in its cultivation

is planted in beds, six inches apart each way, and it takes six years to reach maturity. Thus, to make sure of having a continuous crop, the grower must plant a new supply each year. Each root weighs about two ounces after drying. M.S.

Consult Kains's Ginseng; Harding's Ginseng and Other Medicinal Plants.

GIORDANO, *jor dah' no,* Luca (1632-1705), an Italian painter and son of an artist, born at Naples, nicknamed Luca Fa-presto (Luke Work-fast), and The Thunderbolt. At the age of eight he painted a cherub into one of his father's pictures, a feat which induced the viceroy of Naples to recommend the child for study under Spagnoletto.

In 1687 Charles II of Spain invited him to come to Madrid, where he remained for thirteen years. An anecdote which shows the rapidity with which he worked relates that while the Queen of Spain was in his presence one day he proceeded to paint a portrait of Her Majesty into the picture on which he was engaged. While at Madrid he painted the main staircase at the Escurial, and ornamented a church. After the death of Charles, in 1700, Giordano returned to Naples, having already amassed great wealth. He spent huge sums in acts of munificence and was particularly liberal in his aid to the poorer brethren of his art. He left a vast number of works to his credit, among which are *Christ Expelling the Traders from the Temple,* now in the Naples gallery; frescoes of *Moses and the Brazen Serpent* at Pavia; *The Judgment of Paris* in the Berlin Museum; and some fine paintings in the Dresden galleries.

GIORGIONE, *jor jo nay* ([illegible]), one of the most renowned of Italian painters, the first Venetian to handle brush and colors freely. It was he who modified the older methods of the Venetian school and prepared the way for its final form as represented in the works of the greatest Venetian master, Titian.

His real name was Giorgio Barbarelli, but by his contemporaries he was called Giorgione, meaning "George the Great," because of his tall figure, his intense love for beauty and greatness of mind. He was much employed in decorative painting, having ornamented the façades of several large buildings in Venice with frescoes, but because of climatic conditions and effects of time these have now mostly perished. His pictures are rare, and there is a diversity of opinion among the best judges concerning the genuineness of many assigned to him. *The Concert,* in the Pitti Palace, Florence, is one of his most beautiful works; among other paintings of this master are *The Holy Family,* in the Louvre, Paris; *Jacob Meeting Rachel,* in the Dresden gallery; *Finding of Moses,* in Milan, and *The Sea Storm,* in the Academy of Venice.

GIOTTO, or GIOTTO DI BONDONE, *jot' toh de bohn doh' nay* (1276-1336), a painter, sculptor and architect who occupies a prominent place in the history of Italian painting. This estimate of him is especially true, if one considers that during the time in which he lived the resources of his art were still in their infancy and that all he was able to achieve was with the limited means of the times. He laid the foundations upon which all the progress of the Renaissance was afterward firmly based.

Cimabue noticed the young shepherd boy engaged in drawing on large, flat stones. He immediately made the youth his pupil and placed him where he could benefit the world. His greatest architectural masterpiece is the Bell Tower of the Cathedral at Florence, commonly called Giotto's Tower, exquisite in design and rich in decoration. This was unfinished at the time of his death, but he left a perfect model, and it was completed by his pupils. His principal works were his fresco paintings, usually in series, found in all the large cities of Italy. He was a friend of Dante, and his portrait of the poet painted on the wall of the Palace of the Podesta at Florence, recently restored, is one of his most famous works. Twenty of his smaller paintings are to be found in the Florence Academy, two in

Berlin and four in private collections, which originally formed a series of twenty-six illustrative of the lives of Christ and Saint Francis—that is, representative of the circumstances in the two lives which seem to have had certain likenesses. A mosaic of the *Navicella,* or Christ saving Saint Peter from the waves, is now preserved in the portico of Saint Peter's Church at Rome.

GIPSY, *jip'sy.* See GYPSY.

GIRAFFE, *ji raf',* or **CAMELOPARD,** *ka mel'o pard,* the tallest of all animals, a full-grown male being eighteen feet high, three times the height of a tall man. It is found only in Africa, and is a shy, forest-loving, cud-

THE GIRAFFE
In natural position, and when grazing.

chewing animal which feeds on grass and leaves of trees. The Swiss naturalist Rutimeyer fittingly described it as "a most fantastic form of deer."

Its great height is due to an extraordinary length of neck, in which, however, there are but seven vertebrae. The body is short and slopes sharply down to the tail, which ends in a tuft of hair, and to the casual observer it seems that the front legs are longer than the hind ones; however, the long, slender legs, cloven-hoofed, are all the same length. On the long head are two ears of moderate size and two short, bony projections resembling horns. The upper lip, which extends far beyond the nostrils, and the eighteen-inch tongue lend help in the tearing of twigs and leaves from trees. The nostrils can be closed to guard against thorns when feeding, and against blowing sand. The eyes are large, lustrous and appealing, and so placed that the animal can see behind him, in front and at the sides. Excepting a short mane on the neck, a giraffe's hair is short and smooth. It is reddish white, marked with darker spots. Like several other animals of hot, dry countries, giraffes can exist for many days without drinking. When grazing, the animal stands with its front legs far apart, to bring its head nearer to the ground.

This animal, keen of smell, hearing and sight, walks very slowly, but when pursued runs so fleetly in a rocking, camel-like gallop it is not easily overtaken by a horse. But when once reached it is easily killed, and giraffes have been hunted so vigorously for their hides, which are made into whips in use all over South Africa, that they are now rarely seen.

The giraffe requires very careful attention and constant care in captivity or it will die. It is one of the animals arousing most interest in parks and zoölogical gardens, not only for its remarkable appearance, but for its amusing, hopping antics when playing.

The name camelopard is given because the animal is formed somewhat like a camel and is spotted like a leopard. The name *giraffe* means *to walk slowly.* M.S.

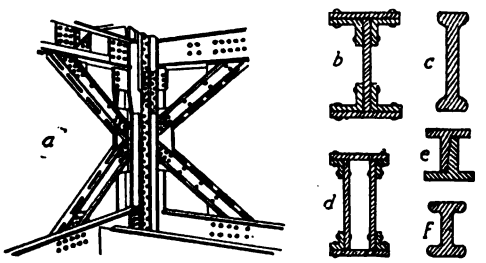
GIRARD, *ji rard',* **COLLEGE,** a school founded in 1848 by the will of Stephen Girard at Philadelphia, Pa., for the education of the "poor white male orphan." He fixed the age of admission between six and ten, while the age of leaving is from fourteen to eighteen. At first, the institution was placed in trust of the city council of Philadelphia, but that plan was found impracticable, so it is now managed by the board of directors of city trusts, which includes the mayor. By one of the peculiar terms of the will "no ecclesiastic, missionary or minister of any sect whatsoever" can be employed in any capacity in the school. When it was organized there were 100 students, but now it has a capacity of 1,520. Forty acres of campus are inclosed by a ten-foot stone wall, and there are twenty buildings in addition to the main building. All branches of work up through high school and along mechanical lines are taught to fit boys for earning their own living. By wise investment the endowment of the school has increased to almost $29,000,000.

Stephen Girard (1750-1831), an American financier and philanthropist, was the chief

financial advisor of the United States government in the War of 1812 and at his death willed $5,000,000 to found Girard College. He was born at Bordeaux, France, the son of a sea captain, and at the age of twenty-three became a captain himself. In 1776 he settled in Philadelphia and after the Revolutionary War became much interested in the first United States Bank, buying most of its stock and buildings in 1812. This he made one of the soundest and most successful institutions in the United States, and in 1814 he took up almost an entire loan of $5,000,000 for the government. Later he became one of the principal stockholders and directors in the second United States Bank. He left his immense fortune to charitable and municipal institutions in Philadelphia and New Orleans.

STEPHEN GIRARD

GIR'DER, a beam, the two ends of which rest upon a pier, wall or other support and carry a load such as a floor or superstructure of a bridge. In buildings where great strength is necessary the girder may rest on an extra



GIRDERS

(*a*) Perspective of a corner steel column, showing girders and wind-braces; (*b*) compound I girder; (*c*) I girder; (*d*) box girder; (*e, f*) wrought-iron girders.

support in the middle, in which case it is known as a *continuous girder*. Wood, cast iron and wrought iron are occasionally used, but steel girders are fast superseding other material. The simplest form of girder is the solid I beam; a more complex and stronger beam is the compound I girder, in which the weight is spread over a larger surface at the two [illegible] girder is a solid beam with [illegible]ted by two web plates, resembling a large rectangular box. In order further to strengthen girders, braces are used at corners, as shown in (*a*) in the illustration. All steel girders are made in rolling mills, by methods similar to those employed in rolling rails for railroad tracks. See ROLLING MILL.

GIRONDISTS, *ji ron' dists,* a political party in the Legislative Assembly and National Convention during the French Revolution (1791-1793). The name was applied because of the fact that the most brilliant exponents of its point of view were deputies from the district near Bordeaux called the Gironde.

Madame Roland, whose salôn became their gathering place, exercised a powerful influence on the spirit and policy of the Girondists, but such party cohesion as they possessed was due to the energy of Brissot, who was regarded as their spokesman in the Assembly and the Jacobin Club. They were distinguished for visionary ideals, rather than for a well-defined policy. They became an easy prey for the more radical Jacobins, and their overthrow was accomplished in June, 1793. See ROLAND DE LA PLATIÈRE, MADAME; JACOBINS; FRENCH REVOLUTION.

GIZZARD, *giz' ard,* a portion of the digestive apparatus found in certain animals, especially in birds, where hard, solid food is ground to fineness. The gizzard of birds is a muscular bag in the stomach, lined with a thick, tough membrane. Food first enters a pouch called the *crop,* where it is moistened in a fluid secreted there. Passing next to the stomach, it is mixed with gastric juice. It then goes into the gizzard, where it is crushed by the muscular action of the thick walls; gravel swallowed by the bird assists in the grinding process. Birds that eat grain have more powerful gizzards than those which eat insects, but in birds of prey the gizzard is only slightly developed. Among other animals possessing a gizzard are the earthworm, the crayfish and its allies, and certain insects. See POULTRY, for picture.

GLACE, *glase,* BAY, a coal-mining town in Nova Scotia, at the east end of Cape Breton Island. It is connected with Sydney, fourteen miles to the west, by the Sydney & Louisburg Railway. Glace Bay is the center of the Dominion Coal Company's properties, which yield most of Nova Scotia's output of coal and employ over 10,000 miners. From the harbor, which is on the Atlantic, coal is shipped to Canadian and foreign ports. There are fisheries and a rich farming district in the vicinity,

and the town has a Marconi wireless station, said to be the most powerful in the world, up to 1917. Population in 1901, 6,945; in 1911, 16,562. A.H.MC K.

GLACIAL, *gla'shal,* **PERIOD, or AGE OF ICE.** Boys and girls who live anywhere in Canada or in almost any part of the Northern United States can hardly believe that once, even though it was thousands upon thousands of years ago, their home land was covered with a vast sheet of ice. As they look about them on forests and streams and fields aglow

IN NORTH AMERICA

IN EUROPE

The solid line at the southern extremity of the glacier fields represents roughly the limits of glaciation.

with beauty their minds can scarcely picture so cold and forbidding a scene as a vast ice mass, over two thousand miles long and half as wide, where now millions of happy people live. When it is realized that in places the ice sheet was supposed to have been as much as a mile, and possibly more, in thickness, the fact seems the more astounding.

The scientific men who tell of this strange age agree that this so-called Glacial Period was that period in the formation of the world in which the change was made from the most recent past to the present era. For this reason the Glacial is also called the *Pleistocene* Period, a term derived from two Greek words meaning the most recent period back of the Age of Man.

The chief characteristic of the Glacial Period was the great ice sheet, which covered over 8,000,000 square miles of the earth's surface. Fully one-half of this ice-covered area was in North America. With the exception of most of Alaska all the northern part of the continent, including all of Canada, was enveloped in ice. The southern boundary of the ice field was marked by the Ohio and the Missouri rivers. In the east the ice sheet included all New England, New York, the northern part of Pennsylvania, and west of the Appalachian Mountains all the states of the great Mississippi Valley as far south as the Ohio River. All of Minnesota, most of North Dakota, the northern part of Montana and Washington and all of Iowa, the eastern parts of South Dakota and Nebraska, with a small portion of Kansas, and more than half of Missouri were also included.

Movement. In Europe the Scandinavian Peninsula, all the lowlands of Belgium, Germany, Denmark, Holland and Russia were under ice. The glaciers of the Alps extended much lower than at present, and a good portion of the British Isles was covered with glaciers. Ice sheets of smaller areas existed in Asia and South America. In North America this great ice sheet gathered around three centers: one in Labrador, east of Hudson Bay; the Keewatin center, west of Hudson Bay; and the Cordilleran center, east of the Rocky Mountains in Canada.

In the course of time the glaciers began to move from the three centers. In each case the movement was toward the lowest level, hence from each center the motion was in nearly all directions. Such was the power of the great mass of ice that it very naturally changed the

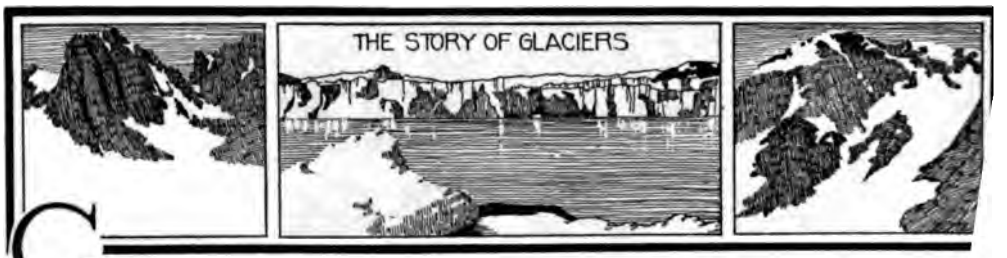
face of the land. Hills were leveled, lake beds were filled up in some places and scooped out in others. Great masses of rock and gravel were carried by the glaciers and deposited along its course, forming drift. In some places in the states south of the Great Lakes this drift forms ranges of low hills from 200 to 250 feet high.

The fine silt deposited on the prairies of the Mississippi Valley and constituting the fertile soil of this region was also another result of this movement. In some localities the rocks were stripped bare of soil, and their surfaces were polished and marked. Lakes were formed in regions where they had not been before, and in other regions lakes were drained by having their outlets lowered. The fertile regions in the lowlands of Europe were formed in the same way.

Life. In parts of North America the mammoth, the mastodon, the glyptodon, the woolly rhinoceros and other large animals roamed over the land. (These animals are described in this set of books.) Similar animals, if no the same, were found in Europe. In Soutl America there were numerous gigantic sloths There is no evidence that man lived in Amer ica, but some geologists think that he live in Europe during the period. Both plant an animal life changed its habitat with the chang of climate. Many present conditions can be ex plained only by reference to the Glacial Perio

Causes. Many theories have been advance to account for the Glacial Period, but none i satisfactory. The following are those most gen erally advanced: (a) that a sudden elevatio of the northern continents caused a fall i temperature; (b) that a change in atmospheri and oceanic currents caused such heavy rain fall as to cause the glaciers; (c) that the Perio was due to a relative change in position of th earth and sun. See GEOLOGY; MORAINE; GLA CIER. W.F.R.

Consult Dawson's *Canadian Ice Age;* Wright' *Ice Age in North America;* Bonney's *Ice Work Past and Present.*



GLACIER, *gla'sher.* Imagine a great river stretching from near the summit of a lofty mountain down its sides for thousands of feet—a river, not of hurrying, sparkling, limpid water, but of solid ice, with a movement so slow that its pace is measured in inches per day rather than in miles per hour.

Some of the snow which falls high up on the mountains is lost by evaporation; in certain altitudes some is melted and in the form of streams begins to run through ruts and gullies down the mountain sides. However, most of this escaping water soon freezes into a long, solid river of ice, and when thick enough begins by its great weight to move in a mass very slowly down towards the valleys. This slow movement, usually less than two feet a day, continues until a point in its descent is reached when evaporation and melting offset supply from higher regions. At this point glacier proper ends and rivers begin, if location is inland. If the end of the glacier is at the sea, great masses of gla ice may break off and drop into the sea become icebergs. Such, in brief, is the picture which may be drawn of this maj awe-inspiring spectacle.

Glaciers are always formed wherever snow falls than melts during the year; quently they are found in cold climat those of the polar regions and on th mits and slopes of high mountains in t perate and tropical latitudes. The best glaciers are those of the Alps in Eur those of the Rocky Mountains in the States, Canada and Alaska. They found in the Scandinavian Peninsul Andes and the Himalaya Mount Greenland and other islands in t Ocean and on the Southern Alps Zealand.

In North America the largest found on the shores of Glacier Bay Mount Fairweather in Alaska. Th

extensive glaciers around Cook's Inlet. Compared with these Alaskan glaciers those of the Alps are mere rivulets. The Malaspina, on Yakutat Bay, Alaska, is 1,550 feet high and has an area of 600 square miles; the Valdez, on Prince William's Sound, is fifteen miles long; the Muir, named for John Muir, at the head of Glacier Bay, is 200 feet high and has a frontage of three miles on the coast. All the valleys of the Northern Alaskan coast are filled with ice rivers, and the fiords of this region were formed by the action of glaciers.

In Glacier National Park, Montana, and in Rocky Mountains Park, just to the north, in Canada, are numerous glaciers which can be easily reached and are interesting to study. Enormous glaciers are also found in the Selkirk Mountains in British Columbia, along the line of the Canadian Pacific Railway. These glaciers are visited by thousands of tourists every season. The most noted glaciers of Europe are the Mer de Glace on Mont Blanc and those on Mont Rosa.

Structure. Glaciers are formed by the freezing and pressing together of masses of snow. After snow has lain upon the ground for some time, the flakes lose their form and the snow becomes granulated, as we see it in snowdrifts in the spring. On the mountains where snow remains from year to year this granulated snow becomes frozen into a porous ice which the French call *neve,* the name generally given it by geologists, but which we call glacial ice. A layer of glacial ice is formed each year, and the lower layers become more compact than the upper, so these lower layers more closely resemble ordinary ice.

Crevasses. The irregular surface over which the glacier moves often causes the ice to crack and form crevasses, which are sometimes more than 100 feet deep. Since these are often filled with light snow they are very dangerous to travelers. The sun melts the ice at the top of the crevasse faster than it does that below, hence the crevasse becomes wedge-shaped and continues to increase in size. Sometimes the crevasses are closed by the movement of the glacier.

Surface. The surface of the glacier becomes very irregular. This is due to the crevasses, to stones and other materials which the glacier gathers as it moves down the mountain and to irregularities due to the unequal melting of the ice. The porous ice melts much faster than that which is more compact, and in time the surface is covered with hollows and slight elevations. Stones shield the ice from the rays of the sun; so wherever they are lodged there are irregular surfaces.

Terminal. The lower end of the glacier is usually very steep, and from under it there issues a stream of ice-cold water formed by the melting of the glacial ice.

Movement. A glacier is the slowest-moving solid body in all the world; it moves down the valley very much as a mass of tar almost solid would move down an incline. The upper and middle parts of the stream travel the fastest, the sides and bottom being held back by friction on the sides and bottom of the valley. The rate of motion can be measured by measuring the movement of any object on the surface. It usually is from eighteen to twenty-four inches a day. The lower end of the glacier may move up the valley in summer and down in winter; or it may remain stationary. This depends upon the rapidity with which the ice is melted. When the end of a glacier juts so far into the sea that it breaks off from the main body the mighty fragment forms an iceberg, which then floats down from the frozen north towards civilization to become a menace to navigation. The story of an iceberg is told under that title.

Moraines. On its way the glacier gathers rocks and other material, which usually form lines which may be tracked through the mass; those near the sides are known as *lateral,* and those toward the middle are *medial,* moraines. The debris deposited at the end of the glacier forms the *terminal* moraine.

Erosion. As a glacier plows its way down the valley it carries along with it all the loose material on its bed. Thus it deepens the valley, lays bare the rocks and polishes them and marks them with *striae* (scratches). The work of erosion now performed by glaciers, however, is inconsiderable. E.S.

Consult Gilbert's *Glaciers and Glaciation;* Hobbs' *Characteristics of Existing Glaciers;* Russell's *Glaciers of North America.*

Related Subjects. The following articles in these volumes will be interesting and helpful in connection with the above:

Erosion	Icebergs
Fiords	Malaspina Glacier
Geology	Mer de Glace
Glacial Period	Moraine
Glacier National Park	Muir Glacier

GLACIER NATIONAL PARK, one of the most beautiful of the American national parks, reserved for the pleasure and recreation of the people. The region is one of romantic beauty;

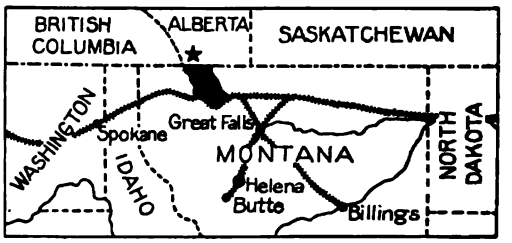
it has been well said that "there is more geography to the square mile than can be found in any other equal area anywhere else on this round earth." It is situated in Northern Montana; on the north is the international boundary line between the United States and Canada, on the east is the Blackfeet Indian Reservation, on the west is Flathead River, and the southern limits are marked by the line of the Great Northern Railway. Adjoining the park on the north is the great Canadian forest and game preserve, the Rocky Mountains National Park.

The area included in the park, about 1,400 square miles, was once set aside by the government as a part of the Blackfeet Indian Reservation. Later it was taken from the Indians, with their consent, because it was believed that further explorations might disclose valuable mineral deposits. This hope, however, was not realized, and finally by act of Congress in February, 1910, it was set aside as a national recreation ground.

The Glaciers. The park takes its name from the glaciers, about sixty in number, which vary in size from a few acres to several miles square. Blackfeet Glacier, nearly five miles square, is the largest, and is said to be the most beautiful glacier in the United States. It is spread out, at an elevation of about 8,000 feet, on the north slope of Mount Jackson (10,023 feet) and Blackfoot Mountain (9,597 feet); on the south slopes of these mountains are the Harrison and Pumpelly glaciers. These glaciers are now separated by the Continental Divide, but ages ago they were a part of a vast ice-sheet which covered the entire region. About six miles to the west of Blackfeet Glacier is the Sperry Glacier, which discharges its melting waters over steep, almost vertical and rocky walls into Avalanche Basin. These are only the most notable of the glaciers; Rainbow, Grinnell, Sexton and Red Eagle are worthy of mention.

Mountains. The main range of the Rocky Mountains extends from north to south almost directly through the center of the park. The Continental Divide here has an average altitude of 7,000 feet, but many of the peaks reach 9,000 or 10,000 feet. Many of them have never been climbed by man. The loftiest peak is Mount Cleveland (10,438 feet), in the northern part of the park. Mount Jackson, Mount Siyeh and Stimson Mountain also have altitudes of more than 10,000 feet, while Mount [illegible] Rising Wolf Mountain, Flinch Peak, [illegible] Mountain, Chief Mountain, Little [illegible] ntain, Gould Mountain and a dozen others exceed 9,000 feet. Squaw Mountain, one of the smaller peaks, is so named because the rocky outline of a squaw is distinctly visible on its southern slope. Triple Divide Mountain (8,001 feet) is called the "roof of the Continent;" from its summit waters flow in three directions—northward through Saint Mary's Lake and River to Hudson Bay; westward through the Flathead River into the Columbia River and thence to the Pacific Ocean; and southward through the Cutbank, Missouri and Mississippi rivers into the Gulf of Mexico and the Atlantic.

One of the most impressive peaks is Going-to-the-Sun Mountain, whose summit towers a mile above the western end of Upper Saint Mary's Lake. The Indian name of this mountain is Mah-tah-pee O-stook-sis Meh-stuck,



LOCATION MAP

Glacier National Park is in Northwestern Montana. The star, across the international boundary, marks the location of Rocky Mountains National Park.

which means "The face of Sour Spirit, who went to the sun after his work was done." According to the legend Sour Spirit was a messenger sent by the Great Sun to the Blackfeet Indians. He taught them how to tan hides and build tepees and canoes, and instructed them in all the arts of Indian life. When he had finished his work, he returned to the Lodge of the Sun-God. As proof of the truth of this story the Indians point to the great stone face on the side of the mountain, left there by the Sour Spirit when he returned to the Sun, so that all men might see and believe.

Lakes. Of all the 250 lakes in the park perhaps the most beautiful is the Upper Saint Mary's, from whose western shore rises Going-to-the-Sun Mountain. It lies at an altitude of 4,500 feet, is about ten miles long, and is completely surrounded by mountains except at the point where the Saint Mary's River carries its surplus waters into the Lower Saint Mary's Lake. The Saint Mary's Lakes are on the east slope of the Continental Divide, but the largest lake, Lake McDonald, is on the west slope. It is eleven miles long, and has an average width

WORLD BOOK

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IN GLACIER NATIONAL PARK. Above is Iceberg Lake. Below is a Blackfoot Indian camp on Cut Bank River.

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N GLACIER NATIONAL PARK. McDermott Falls, above. Below: Going-to-the-Sun Chateau, on Saint Mary Lake.

ıe and a half miles. Like Upper Saint
's Lake, it lies in a depression surrounded
eat peaks rising 3,000 to 5,000 feet above
ırface.

ce McDermott, though one of the smallest
in the park, is also one of the most
us, for it is in the heart of a region of
beauty. In its waters are reflected the
ıes of Gould Mountain and other peaks,
ssuing from its southern end are the lovely
ermott Falls. Near the falls is a perma-
camp, which is the headquarters for side-
to Iceberg Lake, Grinnell Glacier and
points of interest.

berg Lake is the only lake of its kind in
h America. It is only one-half mile long,
it is one of the scenic features of the
At one end is a small glacier, from
ı great blocks of ice, several hundred feet
and weighing thousands of tons, frequently
: off and slide into the water. The alti-
(6,000 feet) is so high that even on the
ıest summer days there are always ice-
, large and small, floating in the lake,
:he water never gets warm enough to
the ice completely. Glacier National
was once the "happy hunting grounds"
ıe Blackfeet Indians, but Iceberg Lake
:hought to be the home of lost souls and
ded spirits.

alanche Lake, not far from Lake Mc-
ld, is another beautiful, though small,
of water. The trail leading to it seems
nerge through a hole in the mountains,
discloses to the astonished traveler a
-bordered little lake, into whose quiet
s four streams tumble noisily. These
ms, carrying the waters from Sperry Gla-
plunge almost headlong over a rocky
pice 2,000 feet high.

imal Life. The animals of the park are
cted by law, and killing, wounding or
ıring any bird or wild animal is an offense
hable by heavy fines. For this reason
Rocky Mountain goats and sheep roam in
:, and many bears have become so tame
they wait on the outskirts of the camps
: fed. A few moose and elk also frequent
park, and deer are common. Antelopes,
:es, wolves and lynxes abound, and geese,
s and other game birds are sometimes
in the lower altitudes. The streams and
are well stocked with fish, and the park
ves its name of "Fisherman's Paradise."
of the greatest fishing trips in the world
be taken from Belton, the western en-
trance to the park, down the Flathead River to Columbia Falls, a distance of twenty miles. Trout are found here probably in greater numbers than in any other waters in North America. The small, flat trout are caught everywhere in the park, and the large Mackinaw and bull trout are found mostly in Saint Mary's Lake. The gamest fighter of them all, and the delight of the angler, is the cutthroat trout. During June, July and August fly-fishing is the rule, but grasshoppers are sometimes used when the trout refuse to rise to a fly. In September, spinners are mostly used. All persons desiring to fish must first obtain a state license.

Transportation and Accommodations. There are two entrances to the park, the eastern at Glacier Park station, the western at Belton, both on the main line of the Great Northern Railway. Within the park trips may be taken on foot, on horseback, by stage-coach or by automobiles. There are many excellent roads, but the higher and remoter points are accessible only to pedestrians or horsemen. Launches are operated on Lake McDonald and Upper Saint Mary's Lake.

The accommodations for visitors are excellent, and suit all tastes and purses. A large modern hotel is located at the Glacier Park station, and dotting the entire area is a series of camps convenient to the points of scenic interest. These camps, which are placed not over a day's walk apart, are groups of small log buildings of the Swiss chalet type. Horses and camping equipment may be rented or purchased, and guides are available at all times. The charges for hotel accommodations and all other services are regulated by the United States government through the Secretary of the Interior, who has immediate control of all national parks. W.F.Z.

GLADIATORS, *glad'i a torz,* men of courage and strength, who, armed only with small shields and short steel swords, fought and killed each other, or placed themselves at the mercy of hungry wild beasts, in the days of ancient Rome. At first these contests were held in honor of heroes who died in battle, the earliest exhibition recorded being in 264 B.C., at the funeral of the father of Marcus and Decimus Brutus. There, prisoners, slaves or condemned criminals were sacrificed. At a later period freemen also fought in the arena, for hire or merely from choice; and still later men of senatorial rank, and even women, fought, and all to gratify the brutal passion

of the people of the day, who found entertainment in the shedding of blood. Schools for gladiators were conducted, and the practice grew to such proportions that it is said the warlike Roman emperor Trajan gave one show lasting over 100 days, during which 2,000 men fought to the death. Such exhibitions were finally abolished by Theodoric, in A. D. 500.

If a gladiator were overpowered in these contests the audience indicated, by pointing thumbs up or thumbs down, whether he should be killed or spared, there being a difference of opinion among authorities about the significance of the two signs. The victor, if a prisoner, sometimes received his freedom, at other times a palm or garland. One of the most famous gladiators of history was Spartacus, a Thracian slave, who incited the War of the Gladiators, 73-71 B. C. His story inspired that favorite American recitation, *The Gladiator's Appeal,* by Elijah Kellogg.

Among gladiatorial statues are the celebrated marble one in Rome, *The Fighting* or *Borghese Gladiator,* and *The Dying Gaul* or *Gladiator,* the original of which is in Paris. See COLOSSEUM.

GLADIOLUS, *gla di' o lus,* sometimes called the *humming-bird flower,* because those strange little birds seek it for nectar, is a popular hothouse and garden plant grown extensively in America and Europe. It is commonly grown

GLADIOLUS FLOWER CLUSTER

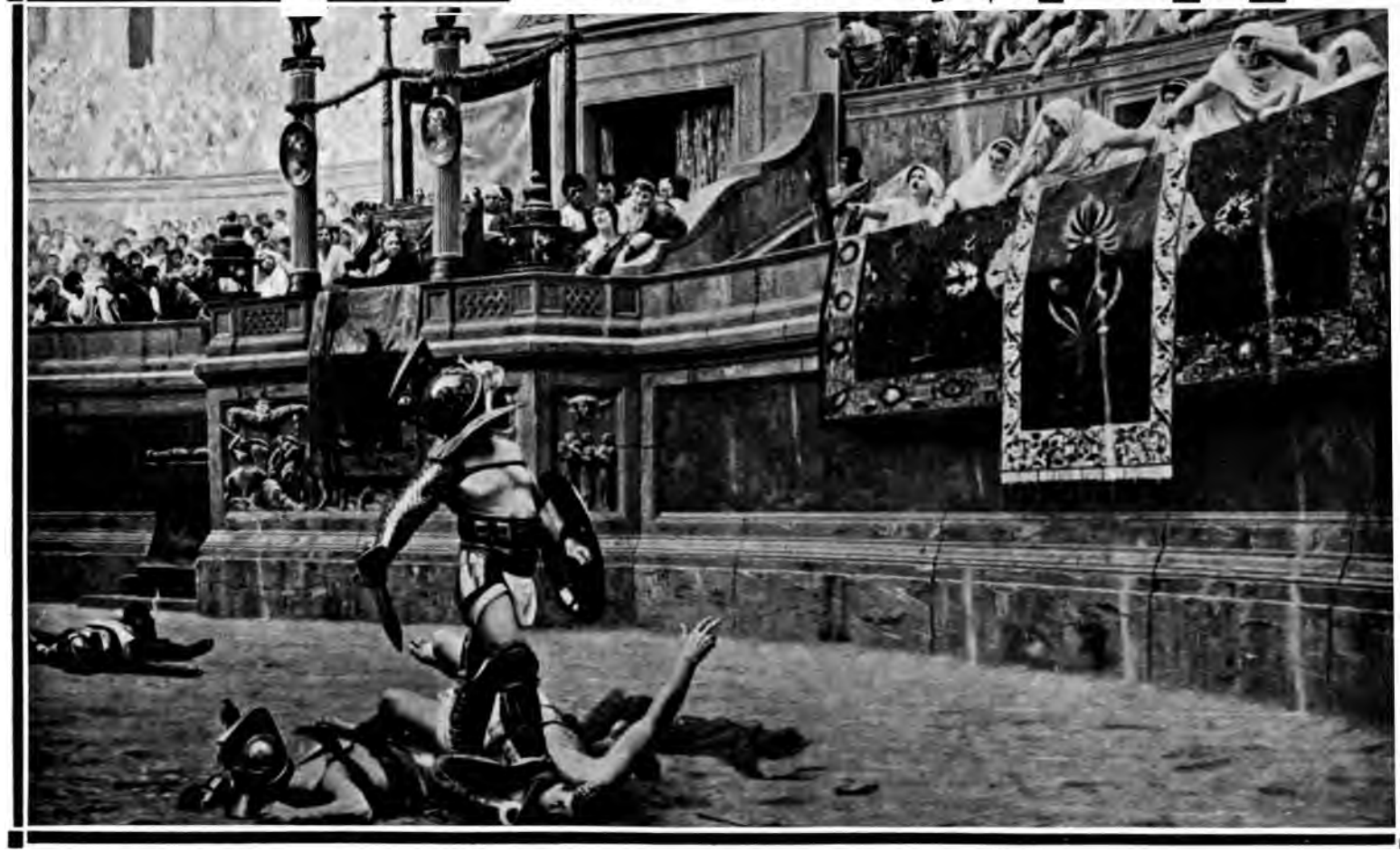
from the bulb, and will thrive in any good garden soil where it receives the full sunlight and free watering. The bulbs should be planted in succession at intervals of two or three weeks during March, April and May. The gladiolus may also be raised from seeds. These should be sown in March or April, and the plants be gathered in October. The little bulbs produced by the plants may then be planted the following spring.

The long, sword-shaped leaves gave the plant the Latin name for *dagger.* The large, irregular, tube-shaped flowers are arranged in long, one-sided clusters, the lower blossoms opening first. If a spike of gladiolus is cut when just the lower flowers are open the buds above will open in succession and keep fresh for a week or ten days. The colors range through all the shades and tints of red to white, and even a blue gladiolus has been produced. Luther Burbank has worked extensively with this plant, producing blossoms on all sides of the stem instead of on one side only, also larger flowers and rich combinations of color.

GLADSTONE, *glad' stun,* WILLIAM EWART (1809-1898), a profound British scholar and statesman, four times Prime Minister, and the most famous of the ministers and political leaders of the long reign of Queen Victoria. His name will forever be associated with those movements which are identified with the progress of English democracy—free trade, equal taxation, the education of the masses and the extension of suffrage—and he was the first Prime Minister to take up the fight for Irish Home Rule. He was born on December 29, 1809, in Liverpool, of Scotch parentage, and was educated at Eton College and at Christ Church, Oxford University. At the age of twenty-four he entered Parliament, where he gave his support to the Tory faction under the leadership of Sir Robert Peel. Between 1845 and 1847 he was Secretary of State for the Colonies in Peel's Cabinet, but during this period was not a member of Parliament. To that body he was reëlected in 1847.

WILLIAM E. GLADSTONE
The most powerful British statesman of the nineteenth century.

During the next few years, in which he was gradually swinging away from Tory principles to Liberalism, Gladstone rose steadily in power and influence, and as Chancellor of the Exchequer, a post which he held at three different times, he prepared budgets that showed his marvelous grasp of financial problems. In



THE GLADIATOR.

The vanquished is pleading for mercy; the victor awaits the sign from the multitude. "Thumbs down" seals the victim's fate. The picture is reproduced from Gérôme's great painting.

1865 he became the Liberal leader in the House of Commons, and three years later began his first term as Prime Minister. In 1869 he carried his bill for the disestablishment of the Irish Church, and in 1870 a bill for the reform of the Irish land system was passed. At this time, also, a system of public schools for the poorer classes was established, and the use of the ballot in voting was introduced. In 1874 the Conservatives regained their power, and Gladstone was succeeded in the Premiership by Disraeli.

Gladstone again came into prominence as a severe critic of the foreign policy of the Conservative Ministry, and in 1880, when the country was carried by the Liberals, he became Prime Minister a second time. During his second Ministry, which ended in 1885, about 2,000,000 new voters were given suffrage rights, and a fairer arrangement of Parliamentary districts was effected. Meanwhile, the movement for Irish Home Rule was making great progress, and when Gladstone became Premier for the third time, in 1886, he announced that Home Rule was to be a feature of the Liberal program. In April of that year the first Home Rule bill was introduced into Parliament. When it failed to pass in the House of Commons, Parliament was dissolved and in the resulting elections the Liberals were defeated. In 1892 the tide again turned and Gladstone took up for the fourth and last time the duties of the Premiership. In 1893 his second Home Rule bill passed in the House of Commons but was rejected by the House of Lords, and a year later, at the age of eighty-five, he laid aside the burdens of public life. Gladstone was the author of several books, among which are *Gleanings from Past Years* and *Studies on Homer and the Homeric Age.* B.M.W.

Consult Bryce's *Gladstone: His Characteristics as Man and Statesman;* Paul's *The Life of W. E. Gladstone.*

Related Subjects. The following articles in these volumes will throw light on Gladstone's activities, and on the history of the times in which he lived:

Budget	Liberal
Chancellor	Premier
Conservative	Tory
Disraeli, Benjamin	Victoria
Home Rule	

GLANDERS, *glan'derz,* a violent, infectious disease to which horses, asses and mules are liable, but which only occasionally attacks cattle, sheep and pigs. The disease was common among horses in the days of the ancient Romans, and no certain remedies have been discovered, even to the present day. The microbe which causes the disease was discovered in 1882. Various tests have been adopted by which to ascertain the presence of glanders; the injection of *mallein,* a substance prepared from the glanders bacillus, is the most effective test. It has no effect on a healthy animal, but if glanders be present a rise of temperature occurs.

In a chronic form the disease is easily distinguished. It usually begins with the formation of ulcers on the neck, shoulders and inside of the thighs. The nostrils discharge an offensive pus from the lungs, high fever sets in and death frequently results in from ten days to three or four weeks. The affected animal may live for years, however, with intermittent attacks, causing infection which may destroy hundreds of other horses. The chronic stage is known as *farcy;* but even in its milder state glanders proves almost equally infectious and destructive. To prevent its spread it is necessary to kill the afflicted animal and thoroughly disinfect stables, harness and everything with which it has come in contact. Dogs, cats and wild animals may contract the disease by eating the flesh of glandered horses, and men have been known to contract glanders by being brought in contact with infected animals.

Consult *Bureau of Animal Industries Bulletin 136,* United States Department of Agriculture, entitled "Various Methods for the Diagnosis of Glanders."

GLANDS, *glandz,* are specially-formed parts of the body, consisting of peculiar cells which manufacture or separate from the blood special substances which may be discharged from the body or be utilized for various purposes.

There are three varieties: *digestive,* or stomach glands, giving out digestive juice; *secreting,* or manufacturing glands, including the sweat, milk and oil glands; and *protective* glands, which absorb from the blood the poison of disease, thus cleansing the blood and protecting the body.

The digestive glands begin in the mouth and pour out a fluid (saliva) which changes starches into sugars; therefore food should be well chewed to give the digestive process a good start. In the stomach are those digestive glands (peptic and pyloric) which, aided by the churning action of the muscular walls of the stomach, pour their digestive fluid on the food, causing further changes; the partly-

ed food is then forced through the lower ng of the stomach (pylorus) into the ine, where the fluids from the liver (bile) pancreas still further digest; here absorp- of the food largely takes place, the intes- being lined with cells which perform this k (see ABSORPTION).

The manufacturing glands are the sweat nds, which draw water from the blood and row it forth in fine drops on the surface of ie skin, in which they are located; the oil lands (sebaceous) which nourish and oil the air and skin; and finally, the milk (mam- nary) glands, which make milk.

The protective glands are known as lymph glands, and are distributed over the entire body, becoming swollen and tender when they absorb poison from the blood, for the protec- tion of the rest of the body. A very few glands are closed, or ductless, having no tubes leading into the rest of the system; the thy- roid gland in the neck is tubeless, and on be- coming enlarged causes the disease known as goiter (which see). J.H.K.

GLASGOW, *glas'ko,* next to London, is the largest city in Great Britain. It is the great- est and most important city in Scotland, and is situated on both banks of the Clyde, in Lanarkshire. Glasgow enjoys the reputation

LOCATION OF GLASGOW

of being the best-governed municipality in the world, and in all matters relating to municipal efficiency and economy it undoubtedly de- serves this rank. When American or Cana- dian cities have wished to investigate munici- pal ownership of public utilities they have sent delegates to Glasgow to study its system.

Under authority granted by special act of Parliament the corporation constitutes what is called a "trust" for each department of city government. The police trust manages the police force, the market trust deals with ket needs, and so on. All public utilities municipally owned and are conducted by perts. The electric street railways, alth hours of employees have been reduced wages raised, with minimum fares of one annually net a profit of over $300,000. sanitary department includes the boar health; under its skilful management the d rate of the city has been reduced in a years from thirty-eight per thousand to teen. (The lowest death rates in the U States are at Saint Paul, Minneapolis and tle, the first two only 11 and the latter per thousand. The death rate for Tor Canada, in average years, is about 12 in a t sand.) The municipal lodging houses are n els and are conducted so as to help the without making paupers of them. During cent years, by the abatement of the sm nuisance, much has also been done to imp the general appearance of the city. M streets have been widened and unsightly bu ings have been destroyed. Glasgow is exce in beauty by few British cities.

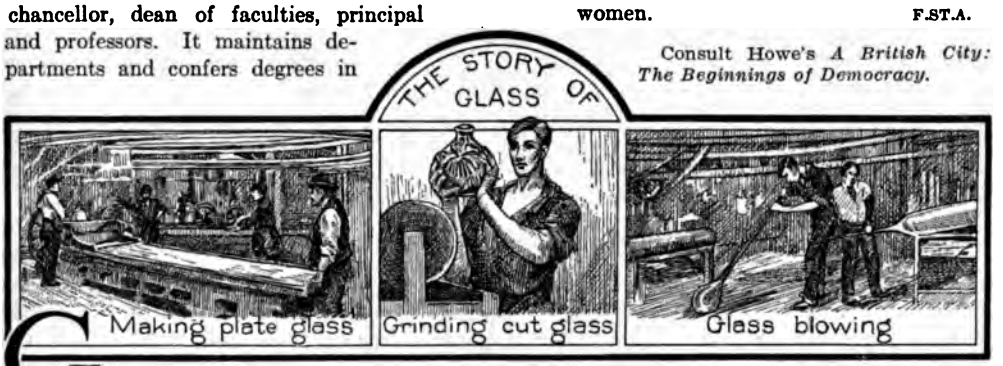
Situated in the midst of a district prod ing an abundance of coal and iron, with splendid harbor accommodating vessels dr ing twenty-six feet of water, and with excel railway communications, Glasgow has n commercial advantages. It is the greatest ter of shipbuilding and its allied industri the world. The city's exports annually re value of nearly $163,000,000, as against in of $83,000,000. Woolen, cotton, and goods, machinery, coal, paper, chemica whisky are the chief exports. Imports raw products, iron, corn, timber, tobac petroleum. The water supply of the drawn from Loch Katrine, the lake to in Scott's *Lady of the Lake,* forty-t distant. The cathedral, erected in th century, is in the early English style tecture, and is noted for its large orately decorated crypt. Glasgow wa in A.D. 560, but did not rise to a tance until about 1116. In 1300 Wi lace, the Scotch patriot, defeated t there, and in the city in 1305 he w into the hands of his enemies. Fr of the union of Scotland and Ire Glasgow has steadily risen in cor educational importance. Popul 784,496.

University of Glasgow, one of seats of learning in Scotland, fo

by Bishop Turnbull. It was endowed by Mary Queen of Scots and her son, James I of England. In 1864 new buildings were erected at a cost of $2,350,000, and further additions have been made at various times. The university is now a corporation consisting of a rector, chancellor, dean of faculties, principal and professors. It maintains departments and confers degrees in arts, science, medicine, surgery, divinity and law. Women are admitted, and in 1893 Queen Margaret College, incorporated into the university, was devoted to their sole use. The students numbered about 2,800 before the War of the Nations, in 1914, and of these 700 were women.

F.ST.A.

Consult Howe's *A British City: The Beginnings of Democracy.*



GLASS, one of those familiar substances that are put to so many uses we take them quite as a matter of course. Yet, common as it is, glass adds more to our daily comfort and happiness than the costliest gems that the mines can yield. Our homes would be dreary places indeed had we no window-panes to give us light and through which to view the world about us, and no one would care to go back to the times when people drank out of gourds and horns instead of glass goblets, and used bottles made of skins.

Glass has become indispensable in the home, in the arts and in the commercial world. It is as much a source of comfort to know that our books are kept protected from dust behind the glass doors of our bookcases, as to be able to see the familiar titles and backs through the transparent casing. The scientist can add his testimony concerning the value of a substance which forms the lenses of the microscope and the telescope, and which is used in countless other devices and instruments. The merchant in the great city, who must utilize every available inch of space, transforms the basement floor of his huge establishment into a miniature department store, and solves the problem of light by having the sidewalks adjoining the building constructed of iron frames containing many glass prisms. In the lovely stained glass windows of the great cathedral and in beautiful vases and costly tableware we see something of the artistic possibilities of this very useful substance.

What Glass Is. Glass is not a natural substance, like gold, silver or coal, but is an artificial compound made by melting together certain ingredients at a very high temperature (from 1832° to 2732° F.). The principal materials used are: (1) sand (or crushed quartz or flint), (2) lime, and (3) sodium carbonate, or potassium carbonate or sodium sulphate. For various forms of glass other materials are added in varying proportions, such as manganese, cobalt, copper, zinc, tin, arsenic, saltpeter, etc.; pigments for coloring are also added. Cheap grades of glass are made from common sea and river sand, but for the manufacture of better qualities the sand is quarried. Lime is found in nearly all varieties, but lead oxide is substituted in making those which require a brilliant luster and a high degree of transparency, such as *flint* glass used for lamp chimneys, for cut glassware and for some of the lenses of optical instruments, and the *strass,* or *paste,* used in imitation diamonds. The lime has the effect of softening the glass, and the injudicious use of this material has caused many a beautiful piece of tableware to become tarnished and even ruined after a year of service. Potash-lime glass is much harder and less easily melted than soda-lime glass.

Processes of Manufacture. In preparing the materials which go into the making of the better grades of glass the manufacturer puts forth every possible effort to free the sand from impurities. In many cases it is stirred in great quantities of water, then burned in the flames of a fire, and, finally, sifted through copper gauze. Of the impurities which enter it, iron is the most troublesome; if there is

present over one-half of one per cent of iron in the sand the latter cannot be used for the manufacture of colorless glass. In the seventeenth century ground flint was used in the best glass, because it was purer than any sand then available. Hence the name *flint glass*, which, curiously enough, is to-day applied to a variety of glass that is extraordinarily soft, and in the manufacture of which no flint is used. The mixing of the ingredients into what the glassmaker calls the "batch" is a process that often requires the services of an expert chemist, and in the best modern factories it is customary to prepare the batch according to special chemical formulas.

The melting furnace may be either of two general types—the *pot furnace* and the *tank furnace*. In the former the ingredients are melted in huge pots made of fire clay, arranged in a circle around a central fire, at the base of a huge chimney. As these vessels are very difficult to make and of uncertain durability, the tank furnace, heated by gas, has come into general use in the glass-making industry. This type of furnace is provided with a tank in which the ingredients are melted and from which the molten mass is drawn. In the largest factories these furnaces are seventy-five feet long, sixteen feet wide and five feet deep. They are usually worked without interruption, new material being fed into them at one end as the supply of melted glass is drawn out at the opposite end.

Window Glass. Window glass was formerly made entirely by hand labor, but in recent years machines for various steps in the process have been introduced. When performed by workmen the process is essentially as follows: For each part of the operation there is one man especially trained for the work. The first step is the gathering. The gatherer dips a long iron blowpipe into the white-hot glass, and skilfully forms on the end a mass of the substance, weighing from twenty to forty pounds. This ball of glass he turns in an iron mold until it assumes the shape of a pear, and then passes it to the blower, who is the master workman of the factory.

The blower, by a process of blowing, swinging and revolving the mass, shapes it into the form of a cylinder, sometimes as many inches long as himself. When it has cooled somewhat he holds the end of the cylinder in the [illegible]ace, blows into the blowpipe, and then [illegible] the mouthpiece with his thumb. The [illegible]hus imprisoned, and expanding with the heat, splits an opening in the end of the cylinder, which the blower enlarges by revolving the end swiftly in the furnace. When the hole is as large as the diameter of the cylinder, and the mass is cooled to cherry-red heat, an assistant detaches the glass from the blowpipe, and the cylinder is cracked lengthwise with a red-hot iron or a diamond on a long handle. The opened cylinder, with the split side up, is next placed on a fire-clay table which revolves in an oven. The heat soon flattens the cylinder into an irregular surface, which the next workman, the flattener, smooths out with a tool called the *polissoir* (French for *polisher*). This is an iron rod, to each end of which a block of wood is fastened. The smoothed sheet is next placed in the coolest part of the furnace and is then removed to the cooling stone. When rigid enough to be moved it is carried to the annealing chamber.

Annealing is for the purpose of preventing breakage when glass is subjected to changes of temperature, and all articles made from glass undergo this process. This breaking is due to the fact that one surface expands or otherwise dilates before the other has had time to be affected. The objects are slowly heated until the melting point approaches, and are then gradually cooled, the process taking place in a chamber having various compartments of different degrees of temperature. The principle is that the glass, which has been distended by heat, contracts evenly throughout as it cools, and the molecules have time to arrange themselves in a stable position. The glass therefore is made "tough."

Plate Glass, which is the most expensive form of window glass, is made by a special process. The ingredients are melted in huge, open vessels, or tanks, some of which have a capacity of two and one-half tons. These vessels rest upon frames behind fire-clay doors. When the melting has reached the required condition the tank is drawn out by a great fork mounted on a truck, and is rolled to the casting table. There it is hoisted by a crane, and the contents are poured over the metal bed. The molten glass is spread out uniformly by means of a heavy roller, and is then placed in the annealing chamber, where it remains for several days. It comes out in the form of rough plate, and must be polished before it is ready for service. Polishing is done by means of grinding machines which rub the surface with sand, emery and rouge, first on one side and then on the other. In this process

The sheet shown above is 8

about forty per cent of the thickness is eliminated, the resulting sheet being from one-fourth to three-eighths of an inch thick.

To make wired plate glass a wire netting is placed between the surfaces of the sheet while the glass is soft; the result is a strong, almost unbreakable pane, extensively used as a fire protection around elevator shafts and where there is danger from too close crowding of buildings. Basement and other windows that are liable to be broken easily are also frequently made of it.

Glass Tableware. A large part of the ordinary glassware that appears on the table is made by pressing. The press consists of an iron mold, containing the design and ornamentation of the article to be made, and a plunger which is worked by a lever. The gatherer places an iron rod into the molten glass, bringing out a quantity of the substance on the end of it. From this lump enough glass is cut to make the article, and the mass is dropped into the mold and pressed into shape by the plunger. When this process is completed the article is taken out and annealed. Some articles are made in two parts; in manufacturing a goblet, for instance, the bowl is shaped in one press and the stem in another. A good deal of the more expensive tableware is made by blowing. In many factories machines operated by compressed air take the place of the human blower.

Cut Glass is the most expensive and ornate tableware in use. The object is first cast in a mold or is blown, and its plain surface is then marked with the chosen design. It is next held against an iron wheel with sharp edges, which is mounted on a horizontal axis, and which cuts the design into the glass. The face of the wheel is kept supplied with coarse sand and water, which drips from a hopper above. It is not always necessary to trace the design before it is cut into the surface, for a workman of special skill and training is able to complete the work with only his eye for a guide. After the design is cut the article is held against a wheel of sandstone, which is so shaped as to have a sharp edge in the middle. The action of this wheel smooths the edges and surfaces made by the cutting wheel; during the process a small stream of water constantly plays upon it. A wooden wheel supplied with pumice stone next gives a finish and polish to the object, and it is finally cleaned by means of a brush made of spun glass. When all the tiny fragments of glass are removed from the grooves and crevices, the article is washed and is then ready for the market.

Bottle Glass. For the methods used in making bottles see the article BOTTLE, subhead *How Bottles Are Made.*

Colored Glass. Oxides of different metals, which are added in small quantities to the

SPECIMENS OF CUT GLASS

usual ingredients, give glass its various colors. Iron produces a pale yellow or a pale green; manganese, a pink, amethyst or violet. Copper gives a deep green or deep blue, but by adding a reducing agent to take the oxygen from the oxide, the metal copper can be set free in extremely minute particles. This imparts a ruby-red color to the glass. A still finer ruby glass is made by using gold in place of copper oxide. A rich blue is produced by cobalt oxide, a milky white by tin oxide, calcium fluoride or bone ash, and many beautiful tints by a combination of the various coloring substances. The exquisite stained-glass windows of many great churches are mosaics of different colored glass, cut and fitted so as to produce a complete design. On others the pictures are painted, and the colors are then burned into the glass. Colored glass, cut into small pieces, is sometimes seen in the ornamental mosaic work that beautifies the interior of public

buildings. Colored glass has the special virtues of holding its color and of not being subject to decay, and it is therefore a valued material for decorative effects.

Some Curiosities of Glass-Making. During the World's Columbian Exposition held at Chicago in 1893 an exhibition of spun glass created wide attention. This was woven into cloth from which was made a dress for the queen regent of Spain. White silk constituted the warp and glass the woof, and the fabric was woven on a hand loom. Spun glass is made by melting a glass rod in the flame of a blowpipe, and drawing the melted thread over a wheel which revolves at a high rate of speed. The iridescent effect seen in frost work on Christmas cards is produced by fine flakes of glass. Another interesting use of glass may be seen in the collection of "fadeless flowers" at Harvard University. There are in the collection 800 large models, representing sprays and clusters of flowers, and over 2,000 magnified parts. Every object is made of glass, and in color and form is an exact duplicate of the natural flower. The flowers were made in Germany by a secret process, and the collection is the only one of its kind in existence.

Historical. The origin of glass making is lost in antiquity. A fanciful story told by the Roman writer Pliny credits a band of Phoenician merchants with the discovery of the art. According to this legend, as the merchants were returning from Egypt they landed on the coast of Palestine, camped on a sandy beach of the River Belus, and there built a fire. Having placed some blocks of niter under their cooking vessels to protect them from the fire, they saw the substance melt, mingle with the sand and form a liquid stream of glass. Pliny, however, does not explain how the mild heat of an open fire could accomplish what to-day requires the intense heat of a modern furnace, so his narrative is regarded merely as an attempt to account for the origin of an art that had reached a considerable degree of perfection in Roman times.

Statistics of Manufacture. The United States imports yearly over $8,000,000 worth of glass; its exports are valued at about $3,800,000. There are about 365 glass factories in the country, engaging the services of nearly 75,000 persons. The capital invested represents a total of nearly $130,000,000, and a year's products have a value of over $92,000,000. The leading states engaged in the industry are, in order of importance, Pennsylvania, Ohio, West Virginia, Indiana, New York, Kansas, New Jersey and Illinois. The glass-making industry in America was greatly stimulated by the outbreak of the War of the Nations, for commerce with two of the greatest glass-producing countries in the world, Austria and Germany, was thereby interrupted.

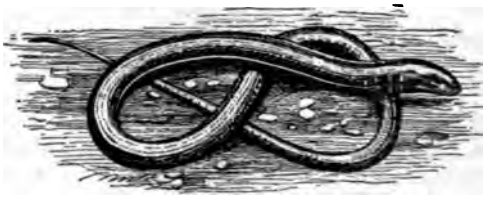
The Canadian provinces of British Columbia, Ontario and Quebec are the chief centers of the industry in the Dominion, the glass manufacturing establishments of which are capitalized at over $2,500,000. The value of the yearly output of manufactured glass is about $2,270,000; in addition, about $1,000,000 worth of stained, cut and ornamental glass is produced. J.F.S.

Consult Gaudy's *Romance of Glass Making;* Dillon's *Glass.*

Related Subjects. The following articles in these volumes contain information more or less closely related to the general subject of glass:

Annealing	Sand
Bottle	Stained Glass
Lime	Wire Glass

GLASS SNAKE, a harmless reptile, snake-like in form, but, like a lizard, with well-developed eyelids and ear-openings. This shining creature of brightly-speckled olive, brown or black, is common in Central, Southern and



GLASS SNAKE

Its average length is 27 inches; greatest diameter of body, ¾ inch; width of head, ⅝ inch; length of head, 1⅛ inch.

parts of the Eastern United States, in Great Britain, Europe, Western Asia and Northern Africa. It is a shy animal and lives chiefly on earthworms, slugs and larvae (young) of insects. Like the lizard, it can easily shed its tail, which, when the animal is frightened, stiffens and may be snapped off by a slight blow; hence the name *glass* "snake."

Blindworm, a smaller brown or silvery-gray reptile similar to the glass "snake," so named because the eyes are small and covered with a transparent skin. It is common in Southern California.

GLAUBER'S, *glau'berz,* **SALT,** a substance named after the German chemist, Johann Rudolf Glauber (1604-1668), who first prepared it

and who ascribed to it many curative qualities. This substance is sodium sulphate after it has absorbed a great quantity of water, its chemical composition being one molecule of sodium sulphate and ten molecules of water. Glauber's salt appears in the form of large, transparent prism crystals. It has a bitter, saline, but not acrid, taste. When it is exposed to air it loses its water and becomes a white powder. Glauber's salt is always found in small quantities in the blood. It occurs in great quantities in many mineral waters, in sea water, and also as the mineral *thenardite*, or *mirabilite*, which is found in the United States, Spain and Russia. Glauber's salt has been used in medicine since the seventeenth century as a purgative. It is also used in the manufacture of glass and in the dyeing industry.

GLAZING. See POTTERY.

GLENS FALLS, N. Y., a city of historical interest and commercial importance, situated in Warren County and on the Hudson River about midway between the northern and southern borders of the state. Albany is sixty-one miles south by rail, and Saratoga Springs is reached by a twenty-mile ride by trolley. The city is also situated on the Champlain Feeder Canal, and is about nine miles south of Lake George. Transportation is provided by the Delaware & Hudson Railroad, constructed to the city in 1869, and by the Hudson Valley Trolley System. In 1910 the population was 15,298; it had increased to 16,894 in 1916, according to Federal estimate.

Manufacturing facilities at Glens Falls are increased by abundant water power provided by the great Spier Falls Dam across the Hudson River, twelve miles north. Most prominent of the varied factories of the city are paper mills, in which over 800 men are employed. Ten shirt, collar and waist factories have 2,000 people on their pay rolls, and a cement company has an annual output of 600,000 barrels. In the vicinity are extensive black marble and limestone quarries. The city has Glens Falls Academy, Saint Mary's Academy, a business school and a library. An $80,000 Federal building erected in 1915, a $400,000 insurance building, a $150,000 bank building and a $150,000 hospital are the most noteworthy buildings.

Glens Falls was settled in 1763 and incorporated as a village in 1837. It was almost totally destroyed by fire in 1864, the loss amounting to $300,000. A similar disaster occurred in 1884. In 1908 the place was incorporated as a city. It is located on the Great War Trail leading from Lake George to Albany, and throughout the French and Indian and the Revolutionary wars a fortified post was located on the outskirts of the city. Burgoyne's forces also encamped here while on their way to Saratoga. The falls and rapids of the Hudson River at this point give the name to the city. These falls, with the cave which lies under the limestone formation here, were made famous through Cooper's *The Last of the Mohicans.* W.K.S.

GLOBE, as ordinarily understood, is a body shaped like a ball. As applied to the study of geography, a globe is a hollow sphere made of metal, plaster or pasteboard, on whose surface is shown a map of the world. It is called the *terrestrial globe,* and its purpose is to indicate the great land and water divisions, present an idea of the earth's geography as a whole, and simplify the study of the seasons and the succession of day and night by actual illustration of the manner in which the earth rotates on its axis. A similar device for studying practical astronomy, called the *celestial globe,* presents a map of the heavens.

The making of an ordinary schoolroom globe is an interesting process. Layers of paper are pasted over a spherical mold to the thickness of cardboard. The resulting shell is cut into two hemispheres, the dividing line marking the equator. The halves are then glued together around a wire representing the earth's axis, at right angles to the equator, its two ends representing the north and south poles. After the globe is covered with a variety of plaster and is made perfectly smooth and round, the map is pasted on. The flat map, such as appears in books, will not do, for the latter are plane surfaces, whereas the sphere has a curved surface. A map must therefore be specially made and printed in sections, with proper allowance for curvature. Small circles are printed for the polar regions, and a number of long strips, or gores, form the rest of the earth. As in all maps, the parallels of latitude and the meridians showing longitude are marked on the globe. See MAP.

In mounting the terrestrial globe on its stand, the axis is slightly inclined, to correspond with the inclination of the earth's axis. A movable vertical band of brass represents the *meridian,* and is divided into degrees and minutes; a stationary horizontal band of wood represents the earth's *horizon* and is marked

with several circles showing the thirty-two points of the compass, the twelve signs of the zodiac and the days and months of the year.

GLOBE, ARIZ., a copper-mining and smelting town and cattle market of Gila County, situated in the southeastern part of the state. It is 575 miles east and south of Los Angeles, Cal., eighty-two miles directly north of Tucson, and on the Arizona Eastern Railroad. The number of inhabitants, in which are included Americans and Mexicans, was 7,083 in 1910. Globe is situated in a mountainous region. Copper mining and cattle raising are the principal industries, and gold and silver mining are also carried on. About 2,500 men are employed by one copper company. Nearly thirty miles northwest of the town is the great Roosevelt Dam, the construction of which cost more than $8,000,000. In the vicinity may be seen the Apache Trail and ruins of the Cliff Dwellers (which see).

The city contains the Old Dominion Library, a high school, Gila Valley Bank, Elks' Building, two hospitals, Kinney Park and a Federal building costing $30,000. Globe received a city charter in 1910. L.M.B.

GLOUCESTER, *glahs'ter,* one of the oldest cities of England, the capital of Gloucestershire. It is beautifully situated on the left bank of the River Severn, thirty-three miles northeast of Bristol, and about seventy-five miles northwest of London, in a valley sheltered by the Cotswold and the Malvern Hills. It is an important port and industrial center, with manufactures of engines, railway cars, agricultural implements, cutlery, large shipbuilding yards, foundries and flour mills. All public utilities are municipally owned and the town is progressive and enterprising. A canal admits vessels from the estuary of the Severn to spacious docks, and extensive commerce is carried on with foreign ports, especially those of the Baltic Sea. Population, in 1911, 50,035.

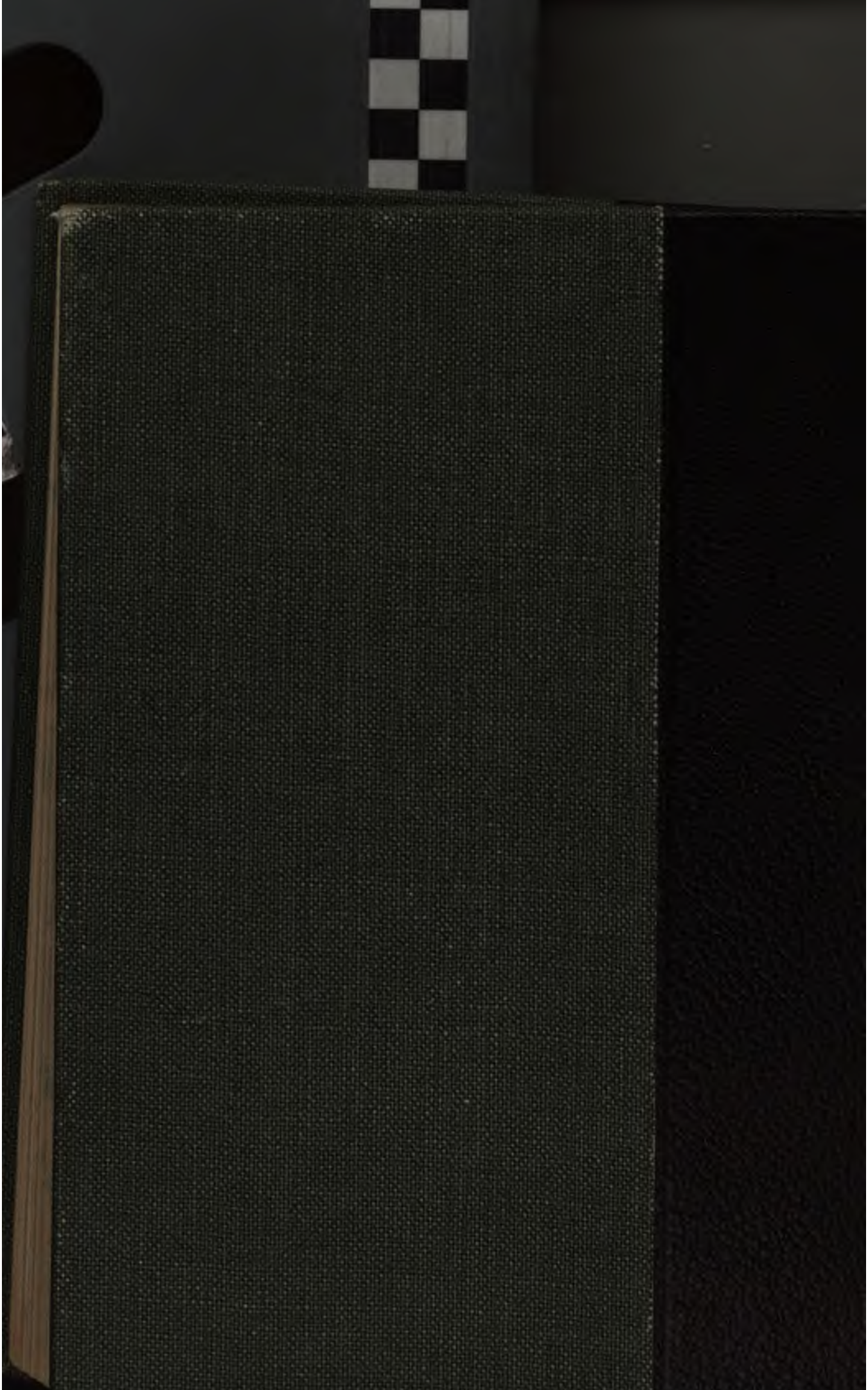
GLOUCESTER, MASS., the principal fishing port in the United States and one of the largest in the world, is situated on the south side of Cape Ann, on Gloucester Harbor, an arm of Massachusetts Bay. Cape Ann is a rocky and barren headland whose coasts have witnessed many marine disasters. Norman's Woe, made famous by Longfellow's poem, *The Wreck of the Hesperus,* is a reef just outside the harbor. The city has an area of about twenty-three square miles and includes the villages of Annisquam, Bay View, East Gloucester, Freshwater Cave, Lanesville, Magnolia, Riverdale and West Gloucester. It is served by the Boston & Maine Railroad and several electric lines, and has steamer service to Boston, about thirty miles southwest. The population, which in 1910 was 24,398, was 24,478 in 1915, according to the state census.

The city offers its many summer visitors an excellent climate and fine beaches, while the quaint villages and the rocky coast are especially attractive to artists. There are a number of parks, a Federal building, city hall, Y. M. C. A. building, state armory, Magnolia and Sawyer libraries, the Gilbert Hospital, Home for Aged Fishermen and the Huntress Home.

Gloucester has a wide, deep harbor, and is the port of 300 fishing vessels; 6,000 men are engaged in the cod, halibut, herring and mackerel fisheries.

The first settlement, which lasted from 1623 to 1625, was made by fishermen from Dorchester, England. At the end of that time some of the settlers returned to England and some went to Naumkeag, now Salem. A permanent settlement was made about 1633, the township was incorporated in 1642, and Gloucester became a city in 1873. In 1908 the commission form of government was adopted.

GLOUCESTER CITY, N. J., a city of Camden County, where battleships and the largest of merchant steamers are constructed. It is on the Delaware River, and by rail is four miles south of Camden and eight miles south of Philadelphia. With the latter city it has connection by ferry; it is served by the Atlantic City and the Pennsylvania railroads. The population, which in 1910 was 9,462, was reported by a Federal census of 1916 to be 11,109. There is a small per cent of Irish and German inhabitants.

At Gloucester City are a United States immigration station, a detention house, administration building and other buildings connected with the port of Philadelphia. The city contains Buena Vista Park and Gloucester Beach. More than 5,000 men are employed in the great shipyards. Gloucester City was incorporated in 1868. A.D.K.

End of Volume Three